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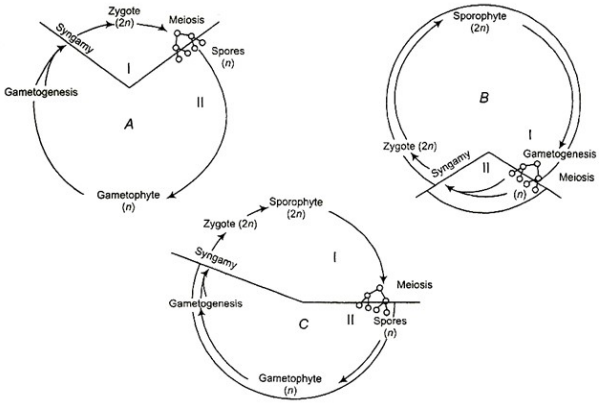
3.PLANT KINGDOM

1. In pteridophytes, gametophytes require ...A... to grow
   a) Cool, damp and shady places b) Dry places
   c) Terrestrial area d) Water
2. Which one of the following pairs of plants are not seed producers?
   a) Fern and *Funaria* b) *Funaria*and*Ficus*
   c) *Ficus*and*Chlamydomonas* d) Fern and *Pinus*
3. A bryophyte, which harbours a nitrogen fixing blue-green alga in its thallus, is
   a) *Pogonatum* b) *Riccia* c) *Marchantia* d) *Anthoceros*
4. Rhodophytes are commonly called as
   a) Blue-green algae b) Red algae c) Brown algae d) Green algae
5. This place in India is called 'The Golden Mine of Liverworts'.
   a) Eastern Himalayas b) Western Himalayas c) Western Ghats d) Eastern Ghats
6. In the alternation of generations the sporophytic generations is ...A... and the gametophytic generation is ...B... . Here A and B refer to
   a) A-2n; B-n b) A-n; B-2n c) A-n; B-n d) A-2n; B-2n
7. Chloroplasts of *Spirogyra* have
   a) Spiral margin b) Smooth of waxy margin
   c) Smooth margin d) None of these
8. In *Selaginella* the adaxial outgrowth from the base of leaf is called
   a) Ligule b) Velum c) Rhizophore d) Glossopodium
9. In *Dryopteris*, the opening mechanism of sporangium is effectively operated by
   a) Stalk b) Stomium c) Annulus d) None of these
10. Calcium encrustation and larvicidal properties are present in
    a) *Chara* b) *Oscillatoria* c) Diatoms d) *Canlerapa*
11. Iodine is obtained from
    a) *Laminaria* b) *Chlorella* c) *Polysiphonia* d) *Porphyra*
12. Number of archegonia in *Cycas* is
    a) 8 b) 4 c) 1 d) 2
13. Which of the following in moss capsule is haploid/gametophytic tissue?
    a) Annulus and peristome b) Calyptra and spore
    c) Columella and theca d) Operculum foot and seta
14. In angiosperms seeds are enclosed by
    a) Flowers b) Fruits c) Ovule d) Parianth
15. Double fertilisation involves
    a) Syngamy and triple fusion b) Double fertilisation
    c) Development of antipodal cell d) Development of synergids
16. Which one of the following is a gymnosperm?
    a) Mango b) Walnut c) *Funaria* d) Chilgoza
17. Which of the following propagates through leaf-tip?
    a) Walking fern b) Sprout-leaf plant c) *Marchantia* d) Moss
18. The spores in the moss plant are formed in
    a) Foot b) Seta c) Capsule d) Both (b) and (c)
19. Antherozoids of *Dryopteris* are
    a) Multiciliated and coiled b) Multiciliated and sickle-shaped
    c) Biciliated and coiled d) Biciliated and sickle-shaped
20. Which has vascular tissue, produces spores but does not have seeds?

a) Bryophyta b) Pteridophyta c) Gymnosperms d) Angiosperms

21. Which of the following correctly represents the type of life cycle patterns from the options given?



a) A-Haplontic, B-Diplontic, C-Haplo-diplontic b) A-Diplontic, B-Haplontic, C-Haplo-diplontic
c) A-Haplo-diplontic, B-Diplontic, C-Haplontic d) A-Diplontic, B-Haplo-diplontic, C-Haplontic

22. Consider the following statements about bryophyte plants
I. The tea prepared from *polytrichumcommune* is used to dissolve kidney and gall bladder stones
II. Many chemical products such as alcohol, ammonium sulphate, paraffin, brown dye, etc., can be obtained from peat
Choose the correct option
a) I is true, II is false b) II is true, I is false
c) Both I and II are true d) Both I and II are false

23. Moss capsule represents a
a) Gametophyte b) Sporophyte c) Part of protonema d) Part of sorus

24. The gametophyte is not an independent, free living generation in
a) *Adiantum* b) *Marchantia* c) *Pinus* d) *Polytrichum*

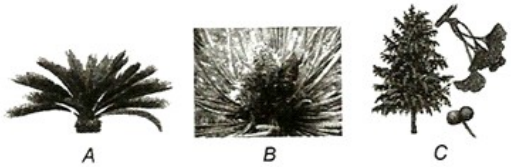
25. Which one is not the feature of *Cycas*?
a) Unbranched stem
b) Pinnate leaves
c) The male or female cones may be borne on the different tree
d) Archegonia is absent

26. The members of brown algae (class-Phaeophyceae) have gelatinous coating outside the, cellulosic cell wall called
a) Algin b) Glycoalgin starch c) Polyalginate d) Polyolefin

27. In Bryophtya, the adult plant body is
a) Sporophyte b) Epiphyte c) Sporophyll d) Gametophyte

28. Difference between algae and bryophytes is
a) Terrestrial habitat b) Sterile jacket c) Biflagellate gametes d) None of the above

29. The correct names of gymnospermic plant *A*, *B* and *C* shown in figure below are



a) A-*Cycas*, B-*Ginkgo*, C-*Pinus* b) A-*Cycas*, B-*Pinus*, C-*Ginkgo*
c) A-*Ginkgo*, B-*Cycas*, C-*Pinus* d) A-*Pinus*, B-*Cycas*, C-*Ginkgo*

30. Which one of the following is an example of chlorophyllousthallophyte?
a) *Volvariella* b) *Spirogyra* c) *Nephrolepis* d) *Gnetum*

31. Which of the following is known as pond silk?
a) *Spirogyra* b) *Ulothrix* c) *Nostoc* d) *Anabaena*

32. Which of the following does not belong to class-Phaeophyceae (brown algae)?

a) *Ectocarpus* and *Dictyota* b) *Laminaria* and *Sargassum*
c) *Fucus* and *Dictyota* d) *Polysiphonia* and *Gelidium*

33. In pteridophyte, the sporophytes consist of leaf-like appendages called
a) Megaphylls b) Sporophylls c) Thalli d) Sporangia

34. Meiosis in *Spirogyra*, *Ulothrix*, *Chlamydomonas* and most of the algae/thallophytes is
a) Sporic b) Zygotic c) Gametic d) Unequal

35. In *Funaria*, stomata are present on the
a) Stem b) Leaves c) Capsule d) Apophysis

36. Gymnosperms are characterised by
a) Multiflagellate sperms b) Nacked seeds
c) Winged seeds d) Seeds inside fruits

37. Which of the statement is correct about *Marchantia*?
I. Plant body is thallus-like structures closely attached to substrate
II. Sporophyte is differentiated into food, seta and capsule
III. Gemma cup located on the thalli
a) I and II b) I and III c) II and III d) I, II and III

38. Heterocysts are found in
a) Cyanophyceae b) Chlorophyceae c) Phaeophyceae d) Rhodophyceae

39. Mosses occur in moist place because
a) The cannot grow on land b) Their gamete fuses in water
c) They lack vascular tissue d) They lack root and stomata

40. Angiospermic plants are characterised by
I. double fertilisation
II. triploid endosperm
III. Diploid endosperm
Choose the correct option from the following regarding above statements
a) I and II are correct b) I and III are correct
c) II and III are correct d) I, II and III are correct

41. Read carefully the following statement about the sexual reproduction in ferns
I. Water is essential for fertilisation
II. Male gametophyte bears antheridia, while female gametophyte bears archegonium, which produces antherozoids and egg cell, respectively
III. Antherozoids and egg cell fuses to give rise zygote. Zygote develops into young embryo. Embryo give rise to sporophyte
Which of the statements given above are correct?
a) I and II b) II and III c) I and III d) I, II and III

42. Which of the following part of *Funaria* sporophyte is involved in the dispersal of spores?
a) Calyptra b) Operculum c) Peristome d) Annulus

43. In …A… gametophytic phase is dominant, while in …B… sporophytic phase in dominant.
Identify the A and B. choose the correct option
a) A-pteridophytes; B-algae b) A-bryophytes; B-pteridphytes
c) A-gymnosperm; B-fungi d) A-angisperms; B-algae

44. In which of the following group would you place a plant, which produce seeds but lacks fruits?
a) Fungi b) Pteridophytes
c) Bryophytes d) Gymnosperms

45. The bryophytes are fundamentally terrestrial plants but require presence of water to complete their life cycle. The water is needed for
I. dehiscence of antheridia
II. liberation of antherozoids
III. transfer of sperms from antheridia to archegonia
IV. opening of archegonial neck

V. the movement of antherozoids into the archegonial neck

Which of the statements given above are correct?

a) I, II and IV b) II, III, IV and V c) III, IV and V d) I, II, III, IV and V

46. In gymnosperms, the nucellus is protected by envelops and this composite structure is known as

a) Ovule b) Ovary c) Anther d) Strobili

47. *Pinus* belong to the class

a) Gnetopsida b) Cycadopsida c) Coniferopsida d) Sphenopsida

48. In comparition to angiosperm, which one of the following algae exhibits haplo-diplontic life cycle

a) *Volvox* b) *Chlamydomonas* c) *Ectocarpus* d) *Fucus*

49. Storage bodies, pyrenoids in the chloroplast contain

a) Protein and starch b) Carbohydrate and protein

c) Polysaccharide and protein d) Starch and lipid

50. The red colour of 'red sea' is due to which of the following blue-green algae?

a) *Chlamydomonas* b) *Anabaena* c) *Microcystis* d) *Trichodesmium*

51. In *Funaria*, the number of peristomial teeth is

a) 6 b) 10 c) 16 d) 32

52. The members of Phaeophyceae are commonly called

a) Green-algae b) Blue algae c) Brown algae d) Golden algae

53. Two adjacent filaments of *Spirogyra affinis* each 10 cells participating in reproduction. How many new *Spirogyra* plants are produced during sexual reproduction?

a) 5 b) 10 c) 20 d) 40

54. Which group of plant constitute the lower bryophytes?

a) Liverworts b) Mosses c) Anthocerotales d) Jungermanniales

55. Algal zone is present in

a) Normal root of *Cycas* b) Coralloid root of *Cycas*

c) Normal root of *Pinus* d) Stem of *Cycas*

56. Isogamy is found in

a) *Spirogyra* b) *Chlamydomonas* c) Both (a) and (b) d) *Fucus*

57. Cleavage polyembryony occurs in

a) *Pinus* b) Mini *Cycas* c) *Cycas* d) *Ephedra*

58. Zygote of *Spirogyra* produces four haploid nuclei in which

a) One is functional b) Two are functional c) Three are functional d) All are functional

59. The members of brown algae are found primarily in

a) Freshwater habitat b) Marine habitat

c) Terrestrial habitat d) On moist rock

60. A prokaryotic autotrophic nitrogen fixing symbiont is found in

a) *Cycas* b) *Cicer* c) *Pisum* d) *Alnus*

61. Sporophytic generation is dominant phase in the life cycle of

a) *Marchentia* b) Ferns c) Mosses d) Liverworts

62. Choose the incorrect statement about mosses?

a) Sexual reproduction occurs by the fusion of antheridia and archegonia, which are produced at the apex of the leafy shoots

b) Sporophyte is differentiated into food, seta and capsule

c) Seta and capsule bears spores, which give rise to gametophyte after meiosis

d) The sporophyte in mosses is more elaborate than that in liverworts

63. Gemmae are asexual buds, which originate from small receptacles called gemma cups. These are found in

a) *Funeria* b) *Marchentia* c) *Fern* d) *Sphagnum*

64. Tallest flowering tree is

a) *Pinus* b) *Cedrus* c) *Sequoia* d) *Eucalyptus*

65. Oogamous means

a) Fusion between female and male gametes. Both are similar in size
b) Fusion between one large female gamete and a smaller non-motile male gamete
c) Fusion between one large female gamete and a smaller motile male gamete
d) Fusion between one smaller female gamete and a large motile male gamete

66. Which is wrong in respect to bryophytes?
a) Water is essential for sexual reproduction
b) Presence of antheridium
c) Presence of ciliated sperms
d) Presence of autotrophic independent sporophyte

67. *Nephrolepis* is a
a) Bryophyte b) Pteridophyte c) Gymnosperm d) Angiosperm

68. 'Club moss' belongs to
a) Algae b) Pteridophyta c) Fungi d) Bryophyte

69. Isogamous mean
I. both gametes are similar in size and non-motile,
II. both gametes are dissimilar in size and motile
III. both gametes are similar in size and motile
IV. both gametes are dissimilar in size and non-motile
Which of the statement(s) given above is/are correct?
a) I and II b) I and III c) II and IV d) Only IV

70. Characters of both conifers and cycads are found in
a) *Ginkgo* b) *Ephedra* c) *Cupressus* d) *Tsuga*

71. The amphibians of plant kingdom are
a) Multicellular non-motile algae b) Bryophytes with simple internal organization
c) Unicellular motile algae d) Pteridophytes with complex internal organization

72. Female sex organ in a flower is
a) Carpel or pistil b) Carpel or androecium
c) Shot d) Stamen

73. Which economically important product is obtained from *Cycas circinalis*?
a) Timber b) Sago c) Essential oil d) Resin

74. Artificial system of classification was given by ...A... and based on ...B...
Fill the blanks with respect to A and B. choose the correct option
a) A-Aristotle; B-anatomical characters
b) A-Linnaeus; B-cytological information
c) A-Linnaeus; B-morphological characters
d) A-Haeckel; B-morphological characters

75. Sea weeds are important source of
a) Chlorine b) Fluorine c) Iodine d) Bromine

76. Terms artificial, natural and phylogenetic are related to types of
a) Cytotaxonomy b) Classification of plants
c) Classification of animals d) Both (b) and (c)

77. Holdfast, stipe and frond constitutes the plant body in case of
a) *Volvox* b) *Chara* c) *Laminaria* d) *Chlamydomonas*

78. In Chlorophyceae, the mode of sexual reproduction is
a) Anisogamy b) Oogamy c) Isogamy d) All of these

79. The positive evidence of aquatic ancestory of bryophytes is indicated by
a) Ciliated sperms b) Gametophytic body c) Biflagellate gametes d) Peristomial teeth

80. In gymnosperm the roots are generally
a) Respiratory root b) Prop root c) Tap root d) Adventitious root

81. Which type of chloroplasts are present in the members of class-Chlorophyceae?
a) Discoid and plate-like b) Reticulate and cup-shaped

c) Spiral or ribbon-shaped
d) All of the above

82. Seed habit is linked to
a) Homospory b) Heterospory c) Parthenogenesis d) Parthenocarpy

83. Algae occur in/on
a) Fresh and marine water
b) Moist stones
c) Moist soils and wood
d) All of these

84. Which of the following plant group is considered as first terrestrial plants to possess vascular tissues xylem and phloem?
a) Bryophytes b) Pteridophytes c) Gymnosperm d) Angiosperm

85. At the base of seta of capsule of moss, there is a haploid brownish growth called
a) Calyptra b) Perigonium c) Vaginula d) Perichaetial

86. *Sphaerocarpus* belongs to
a) Bryophyte b) Pteridophyta c) Gymnosperms d) Angiosperms

87. Egg apparatus of angiosperms consist of
a) One synergid and two egg cells
b) Two synergids and one egg cell
c) One central cell, two polar nuclei and three antipodal cells
d) One egg cell, two polar nuclei and three antipodal cells

88. Meiosis in *Dryopteris* takes place during
a) Gamete formation b) Spore germination c) Zygote formation d) Spore formation

89. Which of the following plants produces seeds but not flowers?
a) Maize b) Mint c) Peepal d) *Pinus*

90. Identify the wrong statements
a) The ovule develops into seed
b) The ovary develops into fruit
c) The triple nucleus develops into endosperm
d) Double fertilisation is the fusion of male gamete with egg

91. Select one of the following pairs of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms
a) Absence of resin duct and leaf venation
b) Presence of vessel elements and absence of archegonia
c) Perianth and two integuments
d) Embryo development and apical meristem

92. From which of the following plants is a medicine for respiratory disorders obtained?
a) *Ephedra* b) *Eucalyptus* c) *Cannabis* d) *Saccharum*

93. In *Funaria*, antheridial branch is called
a) Male flower b) Female head c) Male cone d) Female cone

94. Which of the following is not the feature of gymnosperms?
a) Parallel venation
b) Perennial plants
c) Distinct branches (long and short branches)
d) Xylem with vessels

95. The alga used in space research is
a) *Cephaleuros* b) *Gelidium* c) *Chlorella* d) *Gracilaria*

96. The cones bearing megasporophyll with ovules are called
a) Male strobili b) Female strobili c) Megasporangia d) Microsporangia

97. In *Spirogyra* the sporophytic stage is dominant
a) True
b) False
c) Some times (a) and (b)
d) Neither (a) nor (b)

98. Ovules are borne on
a) Microsporophyll b) Megasporophyll c) Macrosporophyll d) Both (a) and (c)

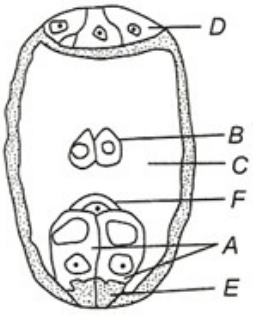
99. Of the following groups, which secrete and deposit calcium carbonate and appear like corals?
a) Green algae b) Brown algae c) Blue-green algae d) All of these

100. In pteridophytes, phloem is without
a) Sieve cells b) Sieve tubes c) Companion cells d) Bastfibres

101. In algae the flagellate (motile) spore is called
a) Aplanospore b) Endospore c) Zoospore d) Akinetes

102. Ovules of gymnosperm is
a) Bitegmic b) Unitegmic c) Naked d) Both (b) and (c)

103. In the given diagram, parts labelled as, A, B, C, D, E and F are respectively identified as



a) A-Synergids, B-Polar nuclei, C-Central cell, D-Antipodals, E-Filiform apparatus, F-Egg cell
b) A-Polar nuclei, B- Egg cell, C-Antipodals, D-Central cells, E-Filiform apparatus, F- Synergids
c) A-Egg cell, B- Synergids, C- Central cells, D- Filiform apparatus, E- Antipodals, F- Polar nuclei
d) A-Central cell, B-Polar nuclei, C- Filiform apparatus, E-Synergids, F-Egg cell

104. Agar, one of the commercial products obtained from red algae is used
a) To grow microbes b) In preparations of ice-creams and jellies
c) Both (a) and (b) d) In sizing textiles and papers

105. Phycoerythrin is present in
a) *Polysiphonia* b) *Laminaria* c) *Kelps* d) *Chlamydomonas*

106. Protonema is formed in
a) Moss b) Liverworts c) Ferns d) *Cycas*

107. Consider the following statements regarding the major pigments and stored food in the different groups of algae and select the correct options given.
I. In Chlorophyceae, the stored food material is starch and the major pigments are chlorophyll-*a*and *d*.
II. In Phaeophyceae, laminarian is the stored food and major pigments are chlorophyll-*a*and *b*.
III. In Rhodophyceae, floridean starch is the stored food and major pigments are chlorophylla-*a*, *d* and phycoerythrin.
a) I is correct, but II and III are incorrect b) I and II are correct, but III is incorrect
c) I and III are correct, but II is incorrect d) III is correct, but I and II are incorrect

108. Read carefully the given statements about algae and choose the correct option
I. The plant body is thalloid
II. Mainly aquatic
III. Reproduction takes place by vegetative, asexual and sexual
IV. *Volvox* and *Ulothrix* are the colonial form of algae
a) I, II and III b) II, III and IV c) I, III and IV d) I, II, III and IV

109. In angiosperms, the pollen grains and ovules are produced in special structure called
a) Fruit b) Seed c) Flower d) Lamina

110. The members of Chlorophyceae are commonly called
a) Red algae b) Brown algae c) Green algae d) Blue-green algae

111. Resin and turpentine are products of
a) Teak b) Oak c) *Eucalyptus* d) Pine

112. In *Cycas*, pollination occurs at ….. celled stage.
a) One b) Two c) Three d) Four

113. Moss peat s used as a packing material for sending flowers and live plants to distant places because
a) It is easily available b) It is hygroscopic
c) It reduces transpiration d) It serves as a disinfectant

114. In the angiosperm ovule, central cell of the embryo sac prior to the triple fusion, contains

a) A single haploid nucleus
b) One diploid nucleus
c) One haploid polar nuclei
d) One diploid and one haploid nuclei

115. The unique feature of bryophytes compared to other green plant group is that
a) They produce spores
b) They lack vascular tissue
c) They lack roots
d) There sporophytes is attached to the gametophyte

116. *Cycas* leaflets are
a) Sessile, straight, oval
b) Sessile, straight, linear-lanceolate
c) Sessile, straight, spiny
d) Sessile, smooth, twisted

117. Which of the following are called vascular cryptogams?
a) Pteridophytes b) Bryophytes c) Gymnosperms d) Algae

118. In gymnosperms the dominate phase is …A… . They are heterosporous, produce …B… and …C… . Here, A, B and C refers to
a) A-sporophyte, B-haploid microspores, C-haploid megaspores
b) A-gametophyte, B-haploid microspores, C-diploid megaspores
c) A-sporophyte, B-diploid microspores, C-diploid megaspores
d) A-gametophyte, B-diploid microspores, C-haploid megaspores

119. Algae are
a) Chlorophyll bearing autotroph
b) Simple and thalloid
c) Both (a) and (b)
d) Heterotroph

120. Consider the following statements
I. They reproduce asexually by non-motile spores and sexually by non-motile gametes
II. In this class, sexual reproduction is oogamous and accompanied by complex post-fertilisation developments
III. The common members are *Polysiphonia*, *Porphyra*, *Gracilaria* and *Gelidium*
The above characteristics are belongs to which class of algae
a) Chlorophyceae b) Phaeophyceae c) Both (a) and (b) d) Rhodophyceae

121. In gymnosperm dominant phase is
a) Sporophyte b) Gametophyte c) Haploid d) Diploid

122. In liverworts asexual reproduction takes place by
a) Gemmae and fragmentation of thalli
b) Fragmentation and zoospores
c) Gemmae formation and spores formation
d) Isogamy and anisogamy

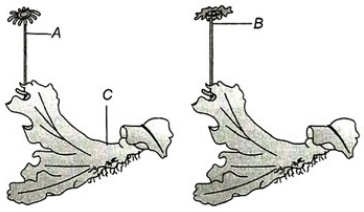
123. Which of the following is the amphibians of the plant kingdom?
a) Angiosperms b) Pteridophytes c) Gymnosperm d) Byrophytes

124. Identify the scientists worked extensively on chlorophyllous and non-chlorophyllousthallophytes, respectively.
I. Iyenger II. Swaminathan
III. Metha IV. Maheswari
a) I and IV b) I and III c) II and III d) III and IV

125. Sago starch is obtained from
a) *Cedrus* b) *Taxus* c) *Pinus* d) *Cycas*

126. In angiosperms endosperm is
a) Haploid b) Diploid c) Triploid d) None of the above

127. Observe the diagrams given below and choose the correct option out of *A* of *C*, in which all the three items *A*, *B* and *C* are rightly identified



a) A-Antheridiophore, B-Archegoniophore, C-Endospore
b) A-Archegoniophore, B-Antheridiophore, C-Gemma cup
c) A- Antheridiophore, B-Archegoniophore, C-Gemma cup
d) A-Archegoniophore, B- Antheridiophore, C-Seta cup

128. Which of the following pteridophytes is heterosporous in nature?
a) *Selaginella* and *Salvinia* b) *Adiantum* and *Equisetum*
c) *Psilotum* and *Lycopodium* d) *Adiantum* and *Psilotum*

129. Which statement is incorrect about *Pinus*?
a) The male and female strobili may be produced on the same tree
b) The male or female strobili may be produced on different trees
c) Male and female sporophylls born on same strobilus
d) Male and female sporophylls born on different strobilus

130. Find out the mis-matched pair.
a) Agar – Polymer of glucose and sulphur containing carbohydrates
b) Chitin – Polymer of glucosamine
c) Peptidoglycan– Polysaccharide linked to peptides
d) Lipopolysaccharides– A complex of lipid and polysaccharide

131. Gymnosperms are naked seeded plants because
a) There is no fruit b) There is no ovule
c) There is no fertilization d) There is no ovary and fruit

132. Consider the following statements about green algae
I. Green algae are green due to the presence of chlorophyll-*a* and *b* pigments localised in chloroplast
II. Algae store food in form of starch in a specialised structures called pyrenoids located in chloroplast. Food may be stored in form of oil droplets
III. Vegetative reproduction occurs through cell division, fragmentation, stolons and tubers
Which of the statements given above are correct?
a) I and II b) I and III c) II and III d) I, II and III

133. Stamen consists of
a) Filament and anther b) Style and stigma c) Filament and pistil d) Anther and pistil

134. Cycads are
a) Homosporous and dioecious b) Homosporous and monoecious
c) Heterosporous and dioecious d) Heterosporous and monoecious

135. 'Chilgoza' a gymnospermic seed that is eaten as dry fruit is produced by
a) *Pinus roxburghii* b) *Pinus geradiana*
c) *Ginkgo biloba* d) *Cedrus deodara*

136. In *Funaria* capsule, dispersal of spores takes place through
a) Peristomial teeth b) Annulus c) Calyptra d) Operculum

137. The plant body of all bryophytes are haploid and thallus like having
a) True root, stem and leaves
b) Root-like, leaf-like or steam like structure

c) Vascular tissues (xylem and phloem)
d) Complex tissues

138. Though *Cycas* has two cotyledons, this is not included in dicot because
a) Of naked ovule
b) They have megaspore
c) Appears as palm tree
d) Has compound leaves

139. Which one of the following is called maiden-hair fern?
a) *Dryopteris*
b) *Pteris*
c) *Adiantum*
d) *Lycopodium*

140. In gymnosperms, the pollen chamber represents
a) A cell in the pollen grain in which the sperms are formed
b) A cavity in the ovule in which pollen grains are stored after pollination
c) An opening in the megagametophyte through which the pollen tube approaches the egg
d) The microsporangium in which pollen grains develop

141. Cyanobacterium is an algae having
a) Blue-green pigment
b) Red pigment
c) Brown pigment
d) Yellow-brown pigment

142. A mature pollen grain of *Pinus* has
a) 2 cells
b) 3 cells
c) 4 cells
d) 5 cells

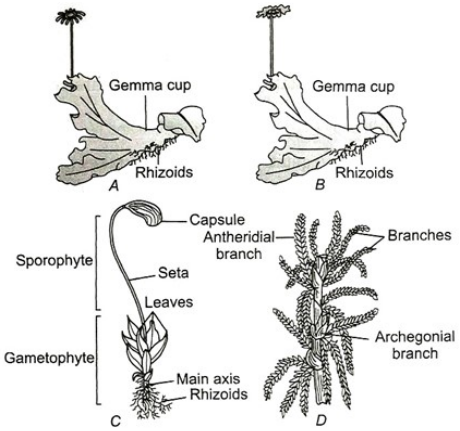
143. Mannitol is reserve food in
a) Rhodophyceae
b) Chlorophyceae
c) Phaeophyceae
d) Xanthophyceae

144. In pteridophytes spore germinate to give rise to
a) Thalloid gametophytes called prothallus
b) Thalloid sporophytes called prothallus
c) Thalloid sporocarp
d) Thalloid, photosynthesis sporophyte

145. Gymnosperms include
a) Medium-sized trees
b) Tall tree
c) Shrubs
d) All of these

146. In homosporous pteridophyte, the gametophyte is
a) Vascular
b) Monoecious
c) Dioecious
d) May be monocious or dioecious

147. Identify the plants shown in figure and select the correct option



a) A-*Marchantia* (male thallus), B-*Marchantia* (female thallus), C-*Funaria,* D-*Sphagnum*
b) A-*Marchantia* (male thallus), B-*Marchantia* (female thallus), C- *Sphagnum,* D-*Funaria*
c) A-*Marchantia* (male thallus), B-*Marchantia* (female thallus), C-Polytrichum, D-Anthoceros
d) A-*Marchantia* (female thallus), B-*Marchantia* (male thallus), C-*Anthoceros*, D-*Polytrichum*

148. Anther produces
a) Pollen grains
b) Spores
c) Gametes
d) Egg cell

149. The only positive evidence of aquatic ancestry of bryophyte is
a) Thread like protonema
b) Green colour
c) Some forms are still aquatic
d) Ciliated sperms

150. The heart-shaped form of prothallus represents
a) Dioecious
b) Monoeciousssporophyte

c) Monoecious gametophyte d) None of the above

151. Which of the following statements is right?
a) Fronds are found in bryophytes b) Multiciliate sperms are found in angiosperms
c) Diatoms produce basidiospores d) Heterocysts are found in *Nostoc*

152. Classification on the basis of chemical constituents of plant is known as
a) Molecular taxonomy b) Chemical taxonomy
c) Chemotaxonomy d) Chemosynthetic classification

153. Which of the following liverworts have thalloid plant body?
a) *Marchentia* b) *Funeria* c) *Sphagnum* d) *Pogonatum*

154. Phycology is the study of
a) Algae b) Fern c) Fungi d) Bryophytes

155. Consider the following statements about bryophytes
I. Sexual reproduction is oogamous type
II. The sex organs are multicellular and jacketed with sterile jacket
III. The haploid gametophytes is dominant stage in the life cycle bryophytes
Which of the statements given above are correct?
a) I and II b) I and III c) II and III d) I, IIand III

156. Chlorophyll-*b* is not present in
a) Green algae b) Bryophytes c) *Spirogyra* d) Blue-green algae

157. Natural system of classification were based upon
a) Structural embryology b) Phytochemistry
c) Anatomy d) All of the above

158. Largest moss is
a) *Pogonatum* b) *Funaria* c) *Dawsonia* d) *Polytrichum*

159. Which of the following petridophytes belong to class-Pteropsida?
a) *Equisetum* and *Psilotum*
b) *Lycopodium* and *Adiantum*
c) *Selaginella* and *Pteris*
d) *Pteris* and *Adiantum*

160. *Cycas revoluta* is popularly known as
a) Date palm b) Sago palm c) Sea palm d) Royal palm

161. Pteridophytes are also known as
a) Cryptogams b) Vascular crytogams
c) Amphibious plants d) Phanerogams

162. Endosperm of gymnosperm is
a) Diploid b) Tetraploid c) Haploid d) None of the above

163. Have capacity of absorbing water used to replace cotton and used as a fuel is
a) *Marchantia* b) *Riccia* c) *Sphagnum* d) *Funaria*

164. Which of the following plant materials, is an efficient water imbibant?
a) Lignin b) Pectin c) Agar d) Cellulose

165. The first plants to appear after a forest fire are the ferns, this is because of the survival of their
a) Spores b) Leaves c) Fronds d) Rhizomes

166. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?
a) Types of pigments present in the cell b) Nature of stored food materials in the cell
c) Structural organization of thallus d) Chemical composition of the cell wall

167. Which of the following is /are grouped under phanerogams?
a) Angiosperms b) Gymnosperms c) Pteridophytes d) Both (a) and (b)

168. Calyptra is derived from
a) Archegonia b) Capsule c) Antheridia d) Columella

169. Megaspore mother cell divides …A… to give rise …B… megaspores

Identify the A and B and choose correct option

a) A-mitotically; B-two
b) A-mitiotically; B-four
c) A-amitotically; B-four
d) A-dinomitotically; B-four

170. In *Cycas*

a) Archegonia are present
b) Antheridia are present
c) Archegonia are absent
d) Both (a) and (b)

171. In angiospermic plant pollen grain reaches to embryo sac after its germination on ...A... and through ...B... . Here A and B refer to

a) A-anther; B-micropyle
b) A-stigma; B-pollen tube
c) A-stigma; B-micropyle
d) A-anther; B-pollen tube

172. Largest gametophyte is found in

a) Angiosperms
b) *Polytrichum*
c) *Nephrolepis*
d) *Cycas*

173. Which is the source of turpentine oil?

a) Gymnospermic wood
b) Angiospermic wood
c) Gymnospermic seed
d) Angiospermic seed

174. What is the ratio of equational division that takes place in *Cycas* and angiosperms respectively during the formation of male gametes from pollen grains?

a) 3 : 2
b) 3 : 1
c) 2 : 1
d) 2 : 3

175. In moss, the sporophyte is differentiated into

a) Seta and capsule
b) Foot and seta
c) Protonema, foot and capsule
d) Foot, seta and capsule

176. In algae, sexual reproduction takes place through the fusion of two

a) Spores
b) Fragments
c) Gametes
d) Zoospores

177. In *Spirogyra*, sometimes a ladder-like structure is present due to

a) Vegetative reproduction
b) Asexual reproduction
c) Lateral conjugation
d) Scalariform conjugation

178. Embryo sac consists of

a) One egg cell
b) Two synergids
c) Three antipodal and two polar nuclei
d) All of the above

179. Triple fusion in angiosperms is the fusion of second male gamete with

a) Two polar nuclei (secondary nucleus)
b) Two antipodal cells
c) One antipodal cell
d) Antipodal cell and one synergid cell

180. Carpel consists of

a) Style and stigma
b) Style, stigma and pistil
c) Style, anther and pistil
d) Anther, style and stigma

181. Which of the following is the difference between a monocotyledonous and a dicotyledonous plant?

a) Both are gymnosperms
b) Monocot have two cotyledons, whereas dicot have one cotyledons
c) Monocot have one cotyledons whereas dicot have two cotyledons
d) Monocot plants have one egg cell in embryo sac whereas dicot have two egg cell in embryo sac

182. Which of the following characteristic does not occur in *Pinus*?

a) The number of needles in a spur of *Pinus roxburghii* is three
b) Each vascular bundle in the long shoot of *Pinus* consists of xylem facing towards the centre of the shoot
c) Microsporophyll of *Pinus* bears two microsporangia
d) *Pinus* is a homosporous gymnosperm

183. Bryophytes are called amphibians of plant kingdom because

a) Their reproductive phase requires water
b) Their sex organs are multicellular and jacketed
c) They have tracheids
d) All of the above

184. Calyptra develops from

a) Venter wall of archegonium
b) Outgrowth of gametophyte
c) Neck wall of archegonium
d) Paraphysis of the archegonial branch

185. Species of *Sphagnum*, a moss, provides

a) Oil, that have long been used as fuel
b) Peat (fuel)
c) Agar-agar
d) Antibiotic

186. Spirogyral lateral conjugation takes place in
a) Heterosporous species
b) Homosporous species
c) Heterothallic species
d) Homothallic species

187. Which one of the following classes is included under gymnosperms?
a) Lycopsida
b) Bryopsida
c) Cycadopsida
d) Pteropsida

188. Study the following and identify two characters found in both *Cycas* and *Pteris*.
I. Formation of motile male gametes.
II. Formation of haploid endosperm.
III. Formation of sporophyte directly from gametophyte without gametic union.
IV. Formation of archegonia in female gametophyte.
The correct match is
a) I and IV
b) I and III
c) II and IV
d) III and IV

189. Iodine is found in algae
a) *Ulva*
b) *Ulothrix*
c) *Chlorella*
d) *Laminaria*

190. The members of algae reproduce by
a) Vegetative method
b) Asexual method
c) Sexual method
d) All of these

191. Consider the following statements about sexual reproduction in brown algae?
I. Sexual reproduction may be oogamous isogamous or anisogamous
II. Union of gametes take place in water or within the oogonium
III. The gametes are pear-shaped and bear two laterally attached flagella
Which of the statements given above are correct?
a) I and II
b) I and III
c) II and III
d) I, II and III

192. Which of the following is known as 'bog moss'?
a) *Polytrichum*
b) *Funaria*
c) *Sphagnum*
d) *Porella*

193. Which of the following has multiflagellate sperms?
a) *Equisetum*
b) *Riccia*
c) *Lycopodium*
d) *Anthoceros*

194. Angiospermic plants are divided into
a) Dicot
b) Monocot
c) Both (a) and (b)
d) Heart wood plant and sapwood plant

195. *Cycas* seed is
a) Dicotyledonous
b) Monocotyledonous
c) Dicotyledonous, non-endospermic
d) Monocotyledonous, endospermic

196. The correct statements about bryophytes are
I. the sperms are biflagellate
II. the sperms are released into water and fuses with the egg to produce the zygote out side the body
III. zygotes undergoes reduction division immediately
IV. they produce a multicellular body called a sporophyte
a) I, II and III
b) I, II and IV
c) I and IV
d) III and IV

197. Which of the following is pteridophytes belong to class-Pteropsida?
a) *Equisetum*and*Psilotum*
b) *Lycopodium*and*Adiantum*
c) *Selaginella*and *Pteris*
d) *Pteris*and*Adiantum*

198. The 13-celled male gametophyte in *Selaginella* is
a) 12 cells of antheridium + 1 prothallial cell
b) 10 cells of antheridium + 3 prothallial cells
c) 8 cells of antheridium + 2 prothallial cells
d) None of the above

199. In haplontic life cycle, the dominant generation is
a) Sporophyte
b) Gametophyte
c) Both (a) and (b)
d) None of the above

200. Carrageenin, a jelly-like substance is obtained from

a) *Chondrus* b) *Fucus* c) *Sargassum* d) *Ulothrix*

201. While entering in the neck of a fern archegonium, sperms shows
a) Phototaxy b) Chemotaxy c) Thermotaxy d) Cyclosis

202. Which one of the following plants is monoecious?
a) *Marchantia* b) *Pinus* c) *Cycas* d) Papaya

203. A gymnospermic leaf carries 16 chromosomes. The number of chromosomes in its endosperm is
a) 24 b) 16 c) 12 d) 8

204. Tea and coffee are affected by
a) *Phytophthora* b) *Cephaleuros* c) *Herviella* d) *Albugo candida*

205. Which of the following groups of algae do not have eukaryotic organization?
a) Green algae b) Blue-green algae c) Red algae d) Golden-brown algae

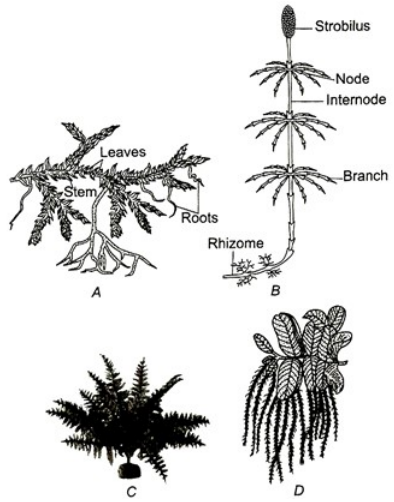
206. In gymnosperms, during pollination pollen grains are released from the microsporangium and transferred to
a) Opening of the ovule b) Archegonia
c) Ovary d) Stigma

207. In *Funaria*, the stomata are found on
a) Foot b) Seta c) Capsule d) All of these

208. Diatoms belong to which class?
a) Phaeophyceae b) Bacillariophyceae c) Chlorophyceae d) Xanthophyceae

209. Which of the following statement is correct about the gametophytic stage in the alteration of generation with in the life cycle?
a) Generation that produces the gametes b) Generation that produces the spores
c) Generation that produces vascular tissue d) The diploid generation

210. Go through the following figures and identify these plants (A, B, C and D)



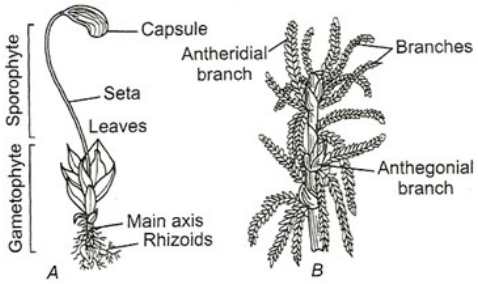
a) A-*Equisetum,* B-*Selaginella,* C-*Fern*, D-*Salvinia*
b) A-*Selaginella,* B-*Equisetum,* C-*Fern,* D-*Salvinia*
c) A- *Fern,* B-*Salvinia,* C- *Equisetum,* D-*Selaginella*
d) A- *Salvinia,* B- *Equisetum,* C- *Fern*, D-*Selaginella*

211. Transfer of pollen grain from anther to the stigma of ovary is called
a) Autogamy b) Pollination c) Syngamy d) Allogamy

212. Which of the following gymnosperms is a bushy trailing shrub?
a) *Ephedra* b) *Cycas* c) *Pinus* d) *Araucaria*

213. Which of the following taxa shows zooidogamousoogamy?
I. *Spirogyra* II. *Funaria*
III. *Pteris* IV. *Cycas*
a) I, II and III b) I, III and IV c) I, II and IV d) II, III and IV

214. Which of the following options correctly identifies the plants their groups from the following structure?



a) A-*Funaria*-Moss; B-*Sphagnum*-Moss
b) A-*Funaria*-Liverwort; B-*Sphagnum*-Moss
c) A-*Selaginella*-Bryophytes; B-*Funaria*-Liverwort
d) A-*Selaginella*-Pteridophytes; B-*Funaria*-Moss

215. Smallest flowering plant is
a) *Ginkgo* b) *Wolffia* c) Tulip d) Sweet bay

216. Gymnosperms lack fruits, why?
a) Seeds absent b) Ovule absent c) Ovary absent d) Ovary fused

217. *Funaria*, *Polytrichum* and *Sphagnum* are the examples of
a) Liverworts b) Ferns c) Mosses d) Pteridophytes

218. Pollen sac in *Cycas* is called
a) Megasporophyll b) Megasporangium c) Microsporophyll d) Microsporangium

219. Chlorenchyma is known to develop in the
a) Spore capsule of a moss
b) Pollen tube of *Pinus*
c) Cytoplasm of *Chlorella*
d) Mycelium of a green mould such as *Aspergillus*

220. Bryophytes are also called 'amphibians of the plant kingdom' because
a) Water is essential for reproduction
b) They are occur in only water
c) These plants can live in soil but are dependent on water for sexual reproduction
d) Water is essential for spore formation

221. Phylogenetic system of classification was given by
a) Engler and Prantl b) Aristotle c) Linnaeus d) Bentham and Hooker

222. Which was first photosynthetic organism?
a) Green algae b) Red algae c) Cyanobacteria d) None of these

223. Male and female gametophytes are independent and free-living in
a) Mustard b) Castor c) *Pinus* d) *Sphagnum*

224. *Chlamydomonas*, *Volvox*, *Ulothrix*, *Spirogyra* and *Chara* are the examples of
a) Class-Chlorophyceae (green algae)
b) Class-Phaeophyceae (brown algae)
c) Class-Rhodophyceae (red algae)
d) Class-Cyanophyceae (blue-green algae) and Chlorphyceae

225. Consider the following statements
I. Agar, one of the commercial products obtained from *Gelidium* and *Gracilaria* are used to grow microbes and in preparations of ice-creams and jellies
II. *Chlorella* and *Spirogyra* are used in sewage disposal ponds
III. Some species of marine algae like *Porphyra*, *Laminaria* and *Sargassum* are used as food
Which of the statements given above are correct?
a) I and II b) I and III c) II and III d) I, II and III

226. In gymnosperm, the multicellular female gametophyte is retained with in
a) Microsporangium b) Megasporangium c) Male gametophyte d) Archegonia

227. Choose the wrong pair
a) Hepaticopsida - *Marchantia*
b) Lycopsida - *Selaginella*
c) Bryopsida - *Anthoceros*
d) Pteropsida - *Dryopteris*

228. *Cycas circinalis* is a source of
a) Resin b) Timber c) Essential oil d) Starch

229. The endosperm in angiosperms develops from
a) Zygote b) Secondary nucleus
c) Chalazal polar nucleus d) Micropylar polar nucleus

230. A microsporophyll in *Pinus* has
a) One microsporangium on the adaxial side b) One microsporangium on the abaxial side
c) Two microsporangia on the abaxial side d) Two microsporangia on the adaxial side

231. The algae used in space research is
a) *Cephaleuros* b) *Gelidium* c) *Chlorella* d) *Gracilaria*

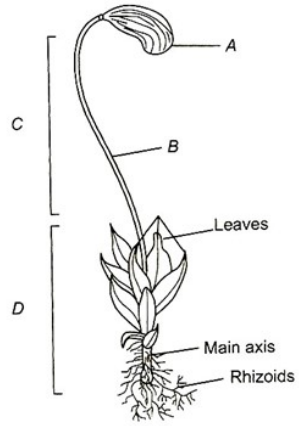
232. Horse tails and ferns are belongs to
a) Gymnosperms b) Bryophytes c) Mosses d) Pteridophytes

233. Chloroplasts, with pyrenoid like structures are found in the leaves of
a) *Funaria* b) *Cycas* c) *Selaginella* d) *Zea mays*

234. Bryophytes mostly occur in
a) Dry area b) Terrestrial area
c) Humid, damp and shaded localities d) in water

235. The number of prothallial cells in male gametophyte of *Pinus* is
a) 2 b) 1 c) 3 d) 0

236. *A*, *B*, *C* and *D* in given figure represents



a) A-Apophysis, B-Capsule, C-Sporophyte, D-Gametophyte
b) A-Capsule, B-Seta, C-Sporophyte, D-Gametophyte
c) A-Apophysis, B-Seta, C-Gametophyte, D-Sporophyte
d) A-Apophysis, B-Capsule, C-Gametophyte, D-Sporophyte

237. The body structure of green algae may be
a) Colonial b) Unicellular c) Filamentous d) All of these

238. Which of the following gymnospermic corolloid roots are associated with N_2-fixing cyanobacteria?
a) *Pinus* b) *Cycas* c) *Cedrus* d) *Ginkgo*

239. Natural system of classification was developed by
a) Linnaeus
b) Engler and Prantl
c) Bentham and Hooker
d) Aristotle

240. Angiosperms differ from gymnosperms in having
a) Fruits b) Cotyledon c) Tracheids d) Broad leaves

241. Consider the following statements regarding gymnosperms and choose the correct option.
I. In gymnosperms, the male and female gametophytes have an independent existence.
II. The multicellular female gametophyte is retained within the megasporangium.
III. The gymnosperms are hterosporous.
Of these statements

a) I and II are true but III is false
b) I and III are true but II is false
c) II and III are false but I is true
d) II and III are true but I is false

242. Pollen tube carries
a) Two male gametes
b) One male gamete
c) Three sperms
d) Four sperms

243. 'Sanjeevanibooti' is
a) *Selaginella kraussiana*
b) *Selaginella chrysocaculos*
c) *Selaginella bryopteris*
d) None of the above

244. *Dryopteris* differs from *Funaria* in having
a) An independent gametophyte
b) An independent sporophyte
c) Swimming antherozoids
d) Archegonia

245. Retort cells occur in
a) *Funaria*
b) *Pogonatum*
c) *Porella*
d) *Sphagnum*

246. *Chlamydomonas* occurs in
a) Freshwater
b) Ponds and lake
c) River
d) Ocean

247. Select the correct statements.
a) Absorption of water by seeds and dry wood are examples of facilitated diffusion
b) The apoplast is the system of interconnected protoplasts
c) *Pinus* seeds cannot germinate and establish without the presence of mycorrhizae
d) The translocation in phloem is unidirectional, whereas in the xylem it is bidirectional

248. The members of Chlorophyceae are usually green due to the dominance of pigments
a) Chlorophyll-*a*
b) Chlorophyll-*b*
c) Chlorophyll-*a* and *b*
d) Chlorophyll-*c*

249. Winged pollen grains are found in
a) *Cycas*
b) *Pinus*
c) *Pteris*
d) *Selaginella*

250. Which region is responsible for origin of rhizoids in *Funaria*?
a) Lateral region
b) Dorsal region
c) Ventral region
d) Basal region

251. Endosperm formation begin with
a) The establishment of the suspensor
b) The fusion of the antipodals
c) The fertilisation of the polar nuclei
d) The syncytial development of the embryo

252. Gametophyte is the dominant phase in the life cycle of
a) *Hibiscus*
b) *Nephrolepis*
c) *Cycas*
d) *Riccia*

253. Which one of the following is a vascular cryptogam?
a) *Equisetum*
b) *Ginkgo*
c) *Marchantia*
d) *Cedrus*

254. Consider the following statements
I. The liverworts grow usually in moist, shady habitats such as banks of streams, marshy ground, damp soil, bark of trees and deep in the woods
II. The leafy members of liverwort have tiny leaf-like appendages in two rows on the stem-like structures
Choose the correct option
a) I is true, II is false
b) I is false, II is true
c) I and II are true
d) I and II are false

255. The giant red wood tree (*Sequoia*) is a/an
a) Angiosperm
b) Fern
c) Pteridophyte
d) Gymnosperm

256. Which of the following statements is wrong about bryophytes?
a) Fertilization takes place in presence of water
b) Gametophytic place is dominant in life cycle
c) Sporophyte is physiologically dependent on gametophyte
d) Zygote undergoes meiosis to produce sporophyte

257. Choose the correct statement about liverworts
I. In liverworts sexual reproduction occurs by the fusion of antherozoids and egg, which are produced in anthridium and archegonium, respectively

II. Both male and female sex organs may be present on same thalli or different thalli
III. Zygote give rise to sporophyte, which is differentiated into food, seta and capsule
IV. Some cells of capsule undergoes meiosis and give rise to haploid spores

a) I, II and III b) II, III and IV c) I, III and IV d) I, II, III and IV

258. Spore dissemination in some liverworts is aided by
a) Elaters b) Indusium c) Calyptras d) Peristome teeth

259. If a sporangium is derived from a single cell, it is called
a) Leptosporangiate b) Eusporangiate c) Heterosporangiate d) Monosporangiate

260. Dispersal of spores in fern takes place through
a) Annulus b) Stomium c) Both (a) and (b) d) Indusium

261. Members of class-Rhodophyceae are known as red algae due to the presence of red pigment
a) *r*-phycoerythrin b) *r*-xanthophyll c) Phycoerythrin d) Fucoxanthin

262. A protein rich green alga is
a) *Chlorella* b) *Spirulina* c) *Spirogyra* d) *Ulothrix*

263. Water bloom is generally caused by
a) Green algae b) Blue-green algae c) Bacteria d) *Hydrilla*

264. Phylogenetic system of classification is based upon
a) Evolutionary relationship of organism b) Cytological information
c) Structural embryology d) All of the above

265. Both heterospory and circinateptyxis occur in
a) *Dryoteris* b) *Pinus* c) *Cycas* d) *Funaria*

266. In *Pinus*, the endosperm is
a) Haploid b) Diploid c) Triploid d) Tetraploid

267. How many pyrenoids are present in the members of class-Chlorophyceae?
a) One b) Two c) One to many d) Pyrenoids are absent

268. Choose the incorrect statement
a) Double fertilisation is unique to gymnosperms and monocotyledons
b) *Sequoia*, a gymnosperm, is one of the tallest trees
c) Phaeophyceae members possess chlorophyll-*a, c,* carotenoids and xanthophylls
d) Moss is a gametophyte, which consists of two stages namely, protonema stage and leafy stage

269. A protein rich blue-green alga is
a) *Chlorella* b) *Spirulina* c) *Spirogyra* d) *Ulothrix*

270. Spores with chloroplast is present in
a) *Selaginella* b) *Equisetum* c) *Puccinia* d) *Rhizopus*

271. The leaves in pteridophytes are small as in
a) *Volvox* b) *Marsilia* c) *Selaginella* d) *Azolla*

272. In bryophytes antheridium produces ...A... and female sex organ archegonium produces ...B... . Here A and B refer to
a) A-uniflagellate antherozoids; B-two egg b) A-biflagellate antherozoids; B-one egg
c) A-non-motile antherozoids; B-one egg d) A-non-motile antherozoids; B-two egg

273. In case of heteroporous pteridophyte the gametophyte is
a) Always dioecious b) Monoecious
c) May be monoecious or dioecious d) Vascular

274. Oogamous type of fusion is found in
a) *Volvox* and *Fucus* b) *Chlamydomonas* c) *Spirogyra* d) All of these

275. Fern gametophyte bears
a) Archegonia b) Antheridia c) Sporangia d) Both (a) and (b)

276. Gametophyte is dominant stage in the life cycle of
a) Bryophyta b) Pteridophyta c) Angiosperms d) Gymnosperms

277. The plant body of bryophytes is
a) More differentiated than that of algae

b) Equally differentiated to that of algae
c) Less differentiated than that of algae
d) Is not differentiated at all

278. In gymnosperms the development of grains take place with in the
a) Megasporangia
b) Microsporangia
c) Male gametophyte
d) Female gametophyte

279. In angiospermic fertilisation, one male gamete fuses with egg to form ...A... , this event is called ...B... . Identify A and B and choose the correct option
a) A-endosperm; B-syngamy
b) A-zygote; B-syngamy
c) A-embryo; B-triple fusion
d) A-endosperm; B-triple fusion

280. Classification on the basis of all observed characters is known as
a) Number and codes taxonomy
b) Numerical taxonomy
c) Countable taxonomy
d) Numerical information taxonomy

281. *Spirogyra*, *Volvox* and *Chlamydomonas* shows
a) Haplontic life cycle
b) Diplontic life cycle
c) Haplo-diplontic life cycle
d) Diplobiontic life cycle

282. When moss spores germinate, the form
a) Leafy gametophyte
b) Capsule
c) Protonema
d) Rhizoids

283. A fern differs from a moss in having
a) Swimming archegonia
b) Swimming antherozoids
c) Independent gametophytes
d) Independent sporophytes

284. If the chromosome number in the leaf of *Funaria* is 20, what will be the chromosome number in the spores?
a) 10
b) 40
c) 20
d) 5

285. Pteridophytes differ from bryophytes in the
a) Motility of sperms
b) Vasculature
c) Archegonia
d) Alternation of generation

286. *Cycas* stem shows
a) Porous wood
b) Manoxylic wood
c) Pycnoxylic wood
d) Ring porous wood

287. In which group of the following would you place the plants having vascular tissue and lacking seeds?
a) Algae
b) Fungi
c) Bryophytes
d) Pteridophytes

288. In brown algae, food is stored in the form of
a) Mannitol
b) Laminarin starch
c) Both (a) and (b)
d) Algin

289. Haploid brown, hairlike, delicate unicellular outgrowths are
a) Root hairs of gymnosperms
b) Paraphysis of mosses
c) Root nodules of pulses
d) Rhizoids of fern plants

290. Gymnosperms produce neither flower nor fruit because they do not possess
a) Embryo
b) Ovary
c) Ovule
d) Seed

291. In mosses the second gametophytic stage is leafy stage. Consider the following statements about leafy stage
I. Leafy stage is produced from the secondary protonema as a lateral bud
II. They consist of upright, slender axes bearing spirally arranged leaves
III. They are attached to the soil through multicellular rhizoids
IV. This leafy stage bears the sex organ
Which of the statements given above are correct?
a) I, II and III
b) I, III and IV
c) II, III and IV
d) I, II, III and IV

292. Alginic acid is found in the cell wall of

a) *Gigartina* b) *Laminaria* c) *Gelidium* d) *Scytonema*

293. Incorrect character of brown alga is
a) Chlorophyll-*a* and *b* present
b) They remain attached
c) Chlorophyll-*a* and *c* present
d) Presence of fucoxanthin

294. Plants forming spores but lacking seed and vascular tissue are
a) Gymnosperms b) Angiosperms c) Bryophytes d) Pteridophytes

295. Living fossil is
a) *Ginkgo biloba* b) *Gnetum ulva* c) *Pinus roxburghii* d) *Cycas revoluta*

296. *Acetabularia* is a
a) Single-celled marine green alga
b) Multicelled marine green alga
c) Single-celled freshwater green alga
d) Multicelled freshwater green alga

297. Which of these is mismatched?
a) Phaneros - Visible
b) Kryptos - Concealed
c) Gymno - Naked
d) Bryon - Liverworts

298. The sclerenchyma of the hypodermis in the *Pinus* needle helps in
a) Increasing the absorptive surface of the cell
b) Checking transpiration
c) Mechanical support
d) Photosynthesis

299. Most algal genera are haplontic some of them such as ...A..., ...B... and ...C... are haplo-diplontic. Here A, B and C refers to
a) A-*Ectocarpus*, B-*Polysiphonia*, C-*Kelps*
b) A-*Volvox*, B-*Spirogyra*, C-*Kelps*
c) A-*Spirogyra*, B-*Polysiphonia*, C-*Ectocarpus*
d) A-*Volvox*, B-*Kelps,* C-*Ectocarpus*

300. From which of the following algae, agar-agar is commercially extracted?
I. *Gracilaria* II. *Fucus*
III. *Sargassum* IV. *Gelidium*
V. *Turbinaria*
a) III and V b) II and III c) IV and V d) I and IV

301. In gymnosperms one of the megaspores develops into multicellular structure called multicellular …… that bears two or more archegonia
a) Male gametophyte
b) Female gamete
c) Female gametophyte
d) Male gamete

302. If the leaf of *Funaria* has 5 chromosomes the primary protonema will have
a) 10 chromosomes b) 5 chromosomes c) 15 chromosomes d) 20 chromosomes

303. In gymnosperms the reduced gametophyte is called
a) Endospore b) Pollen grain c) Ovule d) Aplanospore

304. Double fertilisation occurs among
a) Algae b) Bryophytes c) Angiosperms d) Gymnosperms

305. In algae asexual reproduction occurs by the production of different types of spores. The most common type of spore is
a) Aplanospore
b) Endospore
c) Zoospore
d) Oospore

306. In green algae vegetative reproduction takes place by
a) Fragmentation
b) Different types of spores
c) Both (a) and (b)
d) Conidia

307. Photosynthetic pigments of class-Rhodophyceae (red algae) are
a) Chlorophyll-*a, b* b) Chlorophyll-*a, c* c) Chlorophyll-*a, d* d) Chlorophyll-*a, c* and *d*

308. In a moss, the sporophyte
a) Is partially parasitic on the gametophyte
b) Produces gametes that give rise to the

gametophyte

c) Arises from a spore produced from the gametophyte
d) Manufactures food for itself, as well as for the gametophyte

309. Fruits are not found in gymnosperms because
a) They are not seedless
b) They are not pollinated
c) They have no ovary
d) Fertilization does not takes place

310. Haplontic life cycle is followed by
a) Algae
b) Fungi
c) Gymnosperms
d) Angiosperms

311. Which of the following pteridophytes is heterosporous
a) *Psilotum*
b) *Adiantum*
c) *Equsetum*
d) *Salvinia*

312. Resin duct of gymnospermous stem is an example of
a) Lysigenous cavity
b) Lysogenous cavity
c) Schizogenous cavity
d) Schizolysigenous cavity

313. Fertilisation is the process of
a) Transfer the pollen from anther to stigma
b) Fusion of one male gamete with the egg
c) Formation of seed from ovule
d) Fusion of male nucleus with polar nuclei

314. Angiosperms are also called
a) Seed less plants
b) Fruits less plants
c) Flowering plants
d) All of these

315. Read carefully the following statements
I. *Funaria* possesses unicellular and unbranched rhizoids
II. Gemmae are asexual buds, which originate from small receptacles called gemma cups
III. The *Sphagnum* plants have magnificent property of retaining water
IV. Mosses along with lichens are the first organisms to colonise rocks
Which of the statements given above are correct?
a) I, II and III
b) I, III and IV
c) II, III and IV
d) I, II, III and IV

316. In brown algae asexual reproduction takes place by
a) Aplanospores (apple-shaped and non-motile)
b) Biflagellate gametes (pear-shaped and have two unequal flagella)
c) Endospores (round and have one flagella)
d) Multifilagellate gametes and are sickle-shaped

317. Sporophyte of fern produces
a) Pollen grains
b) Spores
c) Seeds
d) Gametes

318. Fern spores are usually
a) Haploid
b) Diploid
c) Triploid
d) Tetraploid

319. In *Cycas*, diploxylic vascular bundles are found in
a) Stem
b) Root
c) Leaflet
d) Rachis and leaflet

320. A group of plants which are autotrophs, their sex organs are non-jacketed and whose zygotes secrete thick wall are called
a) Phycophytes
b) Lichens
c) Bryophytes
d) Thallophytes

321. Peat moss is
a) *Funaria*
b) *Fern*
c) Algae
d) *Sphagnum*

322. The main plant body in pteridophyte is
a) Sporophyte ($2n$) which is differentiated into root, stem and leaf
b) Sporophyte having no root, stem and leaf
c) Gametophyte (n) which is differentiated into root, stem and leaf
d) Gametophyte having no root, stem and leaf

323. Consider the following statement regarding heterospory
I. Genera like *Selaginella* and *Salvinia* which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous

II. The megaspores and microspores germinate and give rise to female and male gametophyte respectively
III. The female gametophytes in these plants are retained on the parent sporophytes for variable periods
IV. The development of the zygotes into young embryos takes place within the female gametophytes
V. This event is a precursor to the seed habit considered an important step in evolution

a) I, II and III b) II, IV and V c) III, IV and V d) I, II, III, IV and V

324. Common characteristic between bryophytes and pteridophytes is

a) Vascularization b) Terrestrial habit
c) Water for fertilization d) Independent sporophyte

325. Two very distinst generations are found in the life cycle of

a) Bacteria b) *Spirogyra* c) *Volvox* d) Ferns

326. Prothallus of the fern produces

a) Spores b) Gametes c) Both (a) and (b) d) Cones

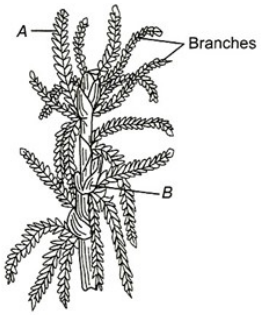
327. Dominant generation in bryophytes is

a) Capsule b) Sporophyte c) Gametophyte d) Seta

328. In gymnosperms, pollination takes place by

a) Water b) Air c) Insects d) Animals

329. *A* and *B* in given figure represents



a) A-Gametophyte branch, B-Sporophyte branch b) A-Antheridial branch, B-Archegonial branch
c) A-Archegonial branch, B-Antheridial branch d) A-Sporophyte branch, B-Gametophyte branch

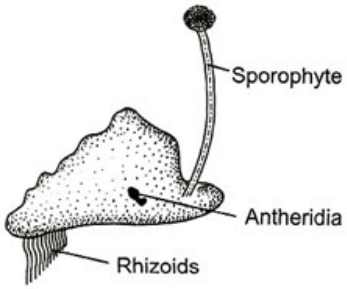
330. Incipient nucleus is found in

a) Myxophyceae b) Phaeophyceae c) Rhodophyceae d) Chlorophyceae

331. Conifers differ from grasses in the

a) Production of seeds from ovules b) Lack of xylem tracheids
c) Absence of pollen tubes d) Formation of endosperm before fertilization

332. Which of the following is correct the ploidy level in labelled organs of plant shown in given figure?



a) Sporophyte-Diploid ($2n$) b) Antheridia-Haploid (n)
c) Rhizoids – Haploid (n) d) All of the above

333. Non-motile, greatly thickened, asexual spore in *Chlamydomonas* is

a) Carpospores b) Akinetes c) Aplanospores d) Hypnospores

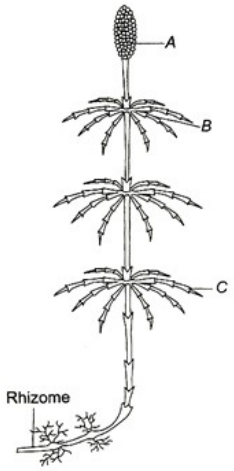
334. Consider the following statements about brown algae

I. The largest kelps are *Nereocystis* and *Macrocystis*
II. Brown algae have gelatinous coating outside the, cellulosic cell wall called algin
III. Food obtained from *Laminaria saccharina* is known as 'Kombu'
Which of the statements given above are correct?

a) I and II b) I and III c) II and III d) I, II and III

335. Double fertilisation is characteristic feature of
a) Gymnosperms b) Angiosperms c) Monocoats d) Bryophytes

336. Identify A, B and C in the following figure and choose the correct option



a) A-Strobilus, B-Node, C-leaves b) A-Strobilus, B-node, C-branch
c) A-Sporophyll, B-Node, C-Internode d) A-Sporophyll, B-Internode, C-Node

337. Reproductive parts of an angiospermic plant are
a) Stamen b) Pistil c) Both (a) and (b) d) Shoot

338. After fertilisation the ovaries develop into
a) Fruit b) Seed coats c) Seed d) Integuments

339. Which of the following algae are suitable for human consumption?
a) *Laminaria* and *Fucus* b) *Gracilaria* and *Chondrus*
c) *Porphyra* and *Spirogyra* d) *Rhodymania* and *Porphyra*

340. In *Ulothrix*, meiosis occurs in
a) Gamete b) Zygospore c) Zoospore d) Thallus

341. Choose the correct statements about protonema
a) Juvenile stage of moss is protonema
b) It consists of slender, green, branching system of filaments
c) Develops directly from a spore
d) All of the above

342. Fruits are mature
a) Ovules b) Ovaries c) Flower d) Peduncles

343. Megasporophyll of *Cycas* is equivalent to
a) Stamen b) Sepal c) Petal d) Carpel

344. Mosses (along with lichen) are of great ecological importance because
a) They colonise on barren rocks and decompose rock b) Its contribution to prevent soil erosion
c) Its contribution in ecological succession d) All of the above

345. Microsporangia of *Cycas* occur over microsporophyll
a) Laterally b) Abaxially c) Adaxially d) Marginally

346. The plant body of bryophytes are thallus like, prostrate or erect and attached to substratum with the help of
a) Unicellular or multicellular roots b) Unicellular or multicellular rhizoids
c) Multicellular roots d) Unicellular roots

347. Heterospory is the production of
a) Sexual and asexual spores b) Large and small spores
c) Haploid and diploid spores d) Diploid and tetraploid spores

348. Bryophytes include
a) Liverworts and mosses

b) Lycopods and mosses
c) Lycopods and liverworts
d) Liverworts and *Volvox*

349. About 90% of the total green algae is found in
a) Marine environment
b) Freshwater environment
c) Rivers
d) Terrestrical environment

350. Mosses are attached to substratum by
a) Roots
b) Capsule
c) Rhizoids
d) Main axis

351. Oil is reserve food in
a) *Chlamydomonas*
b) *Oedogonium*
c) *Vaucheria*
d) *Chara*

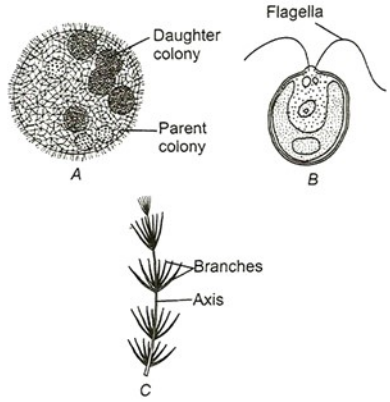
352. Coralloid roots of *Cycas* are useful in
a) N_2 – fixation
b) Absorption
c) Transpiration
d) Fixation

353. The type of pollination in *Cycas* is
a) Entomophily
b) Hydrophily
c) Anemophily
d) Malacophily

354. Spore of *Funaria* on germination gives rise to
a) Protonema
b) Sporophyte
c) Prothallus
d) Capsule

355. Eutrophication is the result of
a) Bryophyte
b) Algae and aquatic plants
c) Gymnosperm
d) Pteridophyte

356. Identify the given figures of algae and select the correct option



a) A-*Chlamydomonas*, B-*Chara*, C-*Volvox*
b) A-*Volvox*, B-*Chlamydomonas*, C-*Chara*
c) A-*Chara*, B-*Laminaria*, C-*Volvox*
d) A-*Porphyra*, B-*Polysiphonia*, C-*Fucus*

357. If number of chromosomes in foot of fern embryo is 8, what should be the number in its spores?
a) 4
b) 8
c) 23
d) 16

358. Agar-agar is obtained from
a) *Chlorella*
b) *Spirogyra*
c) *Ulothrix*
d) *Gelidium*

359. The alga rich in protein is
a) *Chlorella*
b) *Ulothrix*
c) *Laminaria*
d) *Nostoc*

360. A typical of angiospermic embryo sac is usually
a) One celled
b) Three celled
c) Five celled
d) Seven celled

361. Female reproductive part of bryophytes is
a) Antheridium
b) Oogonium
c) Archegonium
d) Sporangium

362. Which of the following group of marine algae are used as food?
a) *Chlamydomonas, Volvox* and *Gracilaria*
b) *Porphyra, Laminaria* and *Sargassum*
c) *Laminaria* and *Gracilaria*
d) *Porphyra* and *Chlamydomonas*

363. *Chlamydomonas nivalis* is responsible for
a) Red snow
b) Red rust of tea
c) Yellow snow
d) Brown snow

364. The thallus of *Volvox* is called

a) Trichome b) Coenobium c) Coenocytes d) Parenchymatous

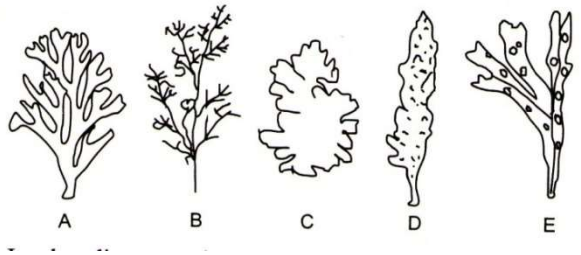
365. Number of peristomial teeth in moss is
a) 16 + 16 b) 16 + 32 c) 8 + 16 d) 32 + 32

366. Plants have ….. in their life cycle
a) Asexual generations only b) Sexual generations only
c) Alternation of generations d) Haplontic generations only

367. The only living fossil, known by the name of 'maiden hair tree' is
a) *Thuja* b) *Pinus* c) *Ginkgo* d) *Araucaria*

368. Chloroplast in *Ulothrix* is
a) Stellate b) Cup-shaped c) Ribbon-shaped d) Girdle-shaped

369.



In the diagram given above, the algae have been labeled as 'A', 'B', 'C', 'D', and 'E'. These algae are respectively identified as
a) *Dictyota*, *Polysiphonia*, *Porphyra*, *Fucus*and*Laminaria*
b) *Porphyra*, *Dictyota*, *Laminaria*,*Fucus*and *Polysiphonia*
c) *Dictyota*, *Polysiphonia*, *Porphyra*,*Laminaria*and *Fucus*
d) *Fucus*, *Porphyra*, *Dictyota*,*Polysiphonia*and *Laminaria*

370. The members of brown algae have
a) Chlorophyll-*a*, chlorophyll-*b*, xanthophylls b) Chlorophyll-*a*, chlorophyll-*c*, xanthophylls and carotenoids
c) Fucoxanthin and xanthophylls d) Chlorophyll-*a* and xanthophylls

371. In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result
a) There is no change in success rate of fertilization b) There is high degree of sterility
c) One can conclude that the plant is apomictic d) Self-fertilization is prevented

372. In flowering plants meiosis occurs at the time of
a) Formation of buds b) Germination of seed
c) Formation of root primordia d) Formation of pollen grains

373. Which of the following is an important source of edible protein?
a) *Spirogyra* b) *Porphyra* c) *Spirulina* d) *Cephaleuros*

374. Floridian starch is reserve food in
a) Rhodophyceae b) Phaeophyceae c) Chlorophyceae d) Xanthophyceae

375. *Chlamydomonas* shows
a) Isogamy b) Anisogamy c) Both (a) and (b) d) Oogamy

376. Mosses are
a) Green
b) Leafy
c) Upright and radial in symmetry
d) All of the above

377. The site of photosynthesis in blue-green algae is
a) Chromatophores b) Mitochondria c) Chloroplast d) Root hair

378. In gymnosperm, the leaves are well-adapted to withstand extremes of temperature, humidity and wind. What are the xeric characters in conifers?
a) Needle-like leaves b) Thick cuticle c) Sunken stomata d) All of these

379. Vegetative reproduction in *Cycas* occurs by
a) Bulbils b) Sporophylls c) Fission d) Scale leaves

380. Classification done on the basis of cytological information, chromosome structure and their behavior, is known as
a) Molecular classification
b) Cytotaxonomy
c) Chemotaxonomy
d) Karyotaxonomy

381. Choose the correct statements for the sporophyte of bryophytes,
I. sporophyte is multicellular, not free living but attached to the gametophyte for nourishment from it
II. some cells of the sporophyte under go meiosis to produce haploid spores
III. these spores germinate to produce gametophyte
a) I and II
b) I and III
c) II and III
d) I, II and III

382. In mosses vegetative reproduction takes place by
a) Fragmentation and budding in the secondary protonema
b) Gemmae formation and endospore formation
c) Gemmae and tubers formation
d) Protonema

383. Eight nucleated female gametophyte is found in
a) Bryophytes
b) Gymnosperms
c) Angiosperms
d) Pteridophytes

384. Vasculature is poorly developed, pith has mucilage canals, parenchyma and medullary rays are abundant in
a) *Cycas*
b) *Pinus*
c) *Selaginella*
d) *Funaria*

385. When a produces two kind of spores, the condition is known as
a) Homospory
b) Heterospory
c) Apospory
d) Sporogenesis

386. Artificial system of classification was given by
a) Aristotle
b) Linnaeus
c) Theophrastus
d) Haeckel

387. In algae, vegetative reproduction mainly takes place by
a) Budding
b) Akinetes
c) Fragmentation
d) Heterocyst

388. Which of the following plant group lack true roots, stem and leaves?
a) Angiosperms
b) Gymnosperms
c) Pteridophytes
d) Bryophytes

389. The characteristic of blue-green algae is
a) DNA without histone
b) Nuclear membrane absent
c) 70 S ribosome
d) All of these

390. Father of Indian Bryology is
a) Raj Kumar
b) S R Kashyap
c) Maheshwari
d) Khurana

391. In which of the following, pyrenoids are present?
a) *Marchantia*
b) *Riccia*
c) *Anthoceros*
d) All of these

392. In which of the following features, *Cycas* resembles with angiosperms?
a) Presence of vessels
b) Circinatevernation
c) Dichotomously branched leaves
d) Pollen tube is the carrier of male gametes

393. Megasporophyll is the term used in gymnosperm to denote
a) Carpel
b) Leaves
c) Female cone
d) Stamens

394. Haplo-diplontic life cycle is followed by
a) Bryophytes and pteridophytes
b) Algae and bryophytes
c) Angiosperm and gymnosperm
d) Bryophytes and gymnosperm

395. Green alga contains
a) Chlorophyll-*a* and *b*
b) Starch
c) Carotenoid
d) All of these

396. Ectophloicsiphonostele is found in
a) *Adiantum* and *Cucurbitaceae*
b) *Osmunda* and *Equisetum*
c) *Marsilea* and *Botrychium*
d) *Dicksonia* and maiden hair fern

397. Roots is some gymnospermic genera have fungal association in the form of ...A... in ...B.... Here, A and B refers to
a) A-mycorrhiza; B-*Pinus*
b) A-mycorrhiza; B-*Cycas*
c) A-lichen; B-*Pinus*
d) A-lichen; B-*Cycas*

398. *Sphagnum* a moss, is used as a packing material for transporting living materials because of its
a) Water holding capacity b) Creeping capacity
c) Alkaline nature as it does not undergo decay d) All of the above
399. Which of the following is true about bryophytes?
a) They are thalloid b) They contain chloroplast
c) They possess archegonia d) All of the above
400. In *Spirogyra*,
a) Filaments in which lateral conjugation occur are homothallic
b) Filaments in which sealariform conjugation occur are homothallic
c) Filaments in which lateral conjugation occur are heterothallic
d) A sexual reproduction occurs by zoospores
401. The protonema is a stage in the life cycle of
a) *Riccia* b) *Funaria* c) All bryophytes d) *Pinus*
402. Identify the alga known for a biological activity called bioluminescence.
a) *Spirogyra* b) *Chlorella* c) *Cyclotella* d) *Noctiluca*
403. The moss plant is
a) Sometimes gametophyte and sometimes sporophyte
b) Predominantly gametophyte with sporophyte attached to it
c) Gametophyte
d) Sporophyte
404. Flagellated male gametes are present in all the three of which one of the following sets?
a) *Anthoceros*, *Funaria* and *Spirogyra* b) *Zygnema*, *Saprolegnia* and *Hydrilla*
c) *Fucus*, *Marsilea* and *Calotropis* d) *Riccia*, *Dryopteris* and *Cycas*
405. In brown algae, brown colour is due to presence of
a) Carotenoids b) Fucoxanthin c) Phycoerythrin d) Chlorophyll
406. *Nostoc* fixes dinitrogen in symbiotic association with the following
I. *Alnus* II. *Gunnera*
III. *Anthoceros* IV. *Casuarina*
a) I and II b) II and III c) I and III d) I and IV
407. The members of Chlorophyceae usually have a rigid cell wall made up of
a) Cellulose (outer layer) and algin (inner layer)
b) Pectose (inner layer) and peptidoglycan (outer layer)
c) Cellulose (inner layer) and pectose (outer layer)
d) Chitin (inner layer) and pectose (outer layer)
408. Zygotic meiosis takes place in
a) *Chlamydomonas* b) Bryophytes c) *Pinus* d) *Dryopteris*
409. Which of the following is correct for *Cycas* reproduction?
a) Zooidogamy is followed by siphonogamy b) Siphonogamy is followed by zooidogamy
c) Siphonogamy only d) Zooidogamy
410. In *Pinus*, the third tier of embryonal cells formed below is known as
a) Rosette tier b) Suspensor tier c) Embryonal tier d) Free-nuclear tier
411. Kingdom-Plantae includes
a) Algae, bryophytes and pteridophytes
b) Algae, bryophytes, pteridophytes, gymnosperms and angiosperms
c) Algae, fungi, peteridophytes, gymnosperms and angiosperms
d) Algae, pteridophytes, gymnosperms and angiosperms
412. Moss spore germinate to form
a) Sporophyte b) Protonema c) Seta d) Capsule
413. Pteridophytes mostly occur in
a) Cool, damp and shady places
b) Hot and sunny places

c) Dry and humid areas
d) In water

414. Protonema is the juvenile filamentous state in the life cycle of
a) *Funaria* b) *Riccia* c) *Marchantia* d) *Laminaria*

415. In which way, mosses affects the quality of soil?
a) Prevents soil erosion
b) Add nutrients to the soil
c) Promotes soil degradation
d) They do no affects soil in any way

416. Which one of the following is considered important in the development of seed habit?
a) Dependent sporophyte
b) Heterospory
c) Haplontic life cycle
d) Free-living gametophyte

417. In capsule of moss, shock absorbers are
a) Trabeculae b) Peristome teeth c) Seta d) Annulus

418. Haploid structure of *Funaria* is
a) Calyptra b) Protonema c) Apophysis d) Operculum

419. Which of the following statement is true about the sporophytic stage in plant life cycle?
a) The haploid generation
b) Generation that produces the gametes
c) Generation that produces the spores
d) Generation that produces vascular

420. Phylogenetic system of classification is also known as
a) Artificial system of classification
b) Hutchinson's system of classification
c) Natural system of classification
d) Whittaker system of classification

421. Transfusion tissue is present in the leaves of
a) *Dryopteris* b) *Cycas* c) *Pinus* d) Both (b) and (c)

422. Gametophytic generation is dominant stage in the life cycle of
a) Pteridophytes b) Angiosperms c) Gymnosperms d) Bryophytes

423. Pyrenoids are made up of
a) Core of starch surrounded by sheath of protein
b) Core of protein surrounded by fatty sheath
c) Proteinaceous centre and starchy sheath
d) Core of nucleic acid surrounded by protein sheath

424. In ferns and mosses, movement of antherozoids towards female component is called
a) Phototaxis b) Chemotaxis c) Hydrotropism d) Thigmotropism

425. Atleast a half of the total CO_2 fixation on earth is carried out by ...A... through ...B... . Here A and B refers to
a) A-bryophytes, B-respiration
b) A-algae, B-photosynthesis
c) A-pteridophytes, B-photosynthesis
d) A-fungi, B-respiration

426. Consider the following statements regarding reproduction in class-Chloropyceae.
I. Asexual reproduction is mainly by flagellated zoospores produced in zoosporangia.
II. The sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous and oogamous.
Which of the statements given above are correct?
a) Only I b) Only II c) I and II d) None of these

427. Laminarin and manitol of class-Phaeophyceae (brown algae) are
a) Proteins
b) Complex carbohydrates
c) Lipoproteins
d) Fat

428. Choose the correct statements.
a) Apophysis is the basal fertile part of the capsule in *Funaria*
b) Apophysis is the apical sterile part of the microsporophyll in *Cycas*
c) Apospory is the development of sporophyte from
d) Apogamy is the development of gametophyte

vegetative cells of the gametophyte from vegetative cells of the sporophyte

429. The first Division, which comes under kingdom-Plantae is
a) Algae b) Fungi c) Cyanobacteria d) Blue-green algae

430. Microsporangia in gymnosperm are produced
a) On the middle portion of microsporophyll
b) On the lowerside of microsporophyll
c) On the middle portion of megasporophyll
d) At the extreme tip of microsporophyll

431. Spore of *Funaria* on germination produces
a) Protonema b) Antheridia c) Archegonia d) Vegetative body

432. Fusion of two gametes, which are dissimilar in size is termed as
a) Oogamy b) Isogamy c) Anisogamy d) Zoogamy

433. Heterosporouspteridophytes always produce
a) Monoecious gametophytes b) Dioecious gametophytes
c) Homothallic gametophytes d) None of the above

434. People recovering from long illness are often advised to include the alga *Spirulina* in their diet because it
a) Makes the food easy to digest b) Is rich in proteins
c) Has antibiotic properties d) Restores the intestinal microflora

435. A ring of multiciliatezoogonidium is found in
a) *Ulothrix* b) *Zygnema* c) *Oedogonium* d) *Chara*

436. Sterile part of *Cycas* microsporophyll is
a) Apophysis b) Sporophore c) Middle part d) Lower part

437. Which of the following is living fossil?
a) *Gnetum* b) *Cycas* c) *Ginkgo* d) Both (b) and (c)

438. Read carefully the following statements about angiospermic sexual fertilisation
I. Pollen tube carries the male gamete towards archegonia and discharge contents in the mouth of archegonium
II. Male gamete fuses with egg to give rise zygote
III. Zygote develops into embryo and embryo into seeds
IV. Seeds are naked
Which of the statement given above are correct?
a) I and II b) I, III and IV c) I, II and IV d) I, II, III and IV

439. Which type of moss is *Funaria*?
a) Acrocarpous moss b) Pleurocarpous moss
c) Anacrogynous moss d) Cleistocarpous moss

440. Select the correctly matched ones.
I. Phaeophyceae - Mannitol
II. Rhodophyceae - Dictyota
III. Chlorophyceae - Non-motile gametes
IV. Rhodophyceae - r-phycoerythrin
a) I, II and III b) II, III and IV c) I and III d) I and IV

441. Algae have cell wall made up of
a) Cellulose, galactans and mannans b) Hemicelluloses, pectins and proteins
c) Pectins, cellulose and proteins d) Cellulose, hemicelluloses and pectins

442. Pyrenoids are present in the ….. in most of the green algae
a) Chloroplast b) Ribosome c) Plastids d) Chromoplast

443. Indusium is found in
a) Algae b) Ferns c) Moss d) *Cycas*

444. External fertilization occurs in majority of
a) Algae b) Fungi c) Liverworts d) Mosses

445. In the life cycle of mosses, the gametophyte has two stages (A and B). These stages can be called

a) A-Protonema; B-Leafy stage
b) A-Protonema; B-Sporogonium
c) A-Sporophyte; B-Gametophyte
d) A-Zygote; B-Spore mother cell

446. Number of meiosis for formation of 64 zygotes in angiosperm is 80 but in gymnosperms number of meiosis for formation of 64 zygotes will
a) 40 b) 80 c) 160 d) 20

447. In gymnosperm the microspores develop into a male gametophyte generation which
a) Is highly reduced and confined to only a limited number of cells
b) Is highly developed
c) Has an independent life
d) Both (a) and (c)

448. In a monoecious plant
a) Male and female sex organs are on different individuals
b) Male and female gametes are of two morphologically distinct types
c) Male and female sex organs are on the same individual
d) All the stamens are fused to form one unit

449. In which of the following, all listed genera belong to the same class of algae?
a) *Chara*, *Fucus*, *Polysiphonia*
b) *Volvox*, *Spirogyra*, *Chlamydomonas*
c) *Porphyra*, *Ectocarpus*, *Ulothrix*
d) *Sargassum*, *Laminaria*, *Gracillaria*

450. Which of the following is incorrect with respect to angiosperms?
a) Endosperm – Triploid
b) Megaspore – Diploid
c) Pollen grain – Haploid
d) Synergid – Haploid

451. In *Cycas* stem, open vascular bundle is characterized by
a) Phloem being sandwitched between xylem
b) Cambium present in between xylem and phloem
c) Xylem being sandwithced between phloem
d) Xylem and phloem occurring on different radii

452. Which green alga shows heterotrichous habit and may have given rise to terrestrial (land) habit?
a) *Chlamydomonas* b) *Fritschiella* c) *Vaucheria* d) *Ulothrix*

453. The characteristic features of bryophytes are
I. main plant body is gametophytic
II. main plant body is sporophytic
III. requirement of water for fertilisation
Which of the statements given above are correct?
a) I and II b) I and III c) II and III d) I, II and III

454. Which is the tallest gymnospermic tree species?
a) *Pinus*
b) *Cycas*
c) *Ginkgo*
d) Red wood tree Siquoia

455. Anisogamous means both gamete are
a) Similar in size and non-motile
b) Dissimilar in size
c) Similar in size and motile
d) Dissimilar in size and non-motile

456. Usually plant body of brown algae is differentiated into
a) Holdfast and frond
b) Stripe and holdfast
c) Frond and stripe
d) Holdfast, stipe and frond

457. *Ulothrix* releases zoospore during
a) Evening b) Morning c) Night d) Noon

458. The kidney-shaped covering of sorus in *Dryopteris*, is called
a) Placenta b) Ramentum c) Sporophyll d) Indusium

459. Pollen grains in *Pinus* are
a) Monosaccate b) Bisaccate c) Trisaccate d) Nonsaccate

460. Characteristic of fern is
a) Circinate venation b) Reticulate venation c) Parallel venation d) None of these

461. Protonema is the stage in the life cycle of
a) *Cycas* b) *Funaria* c) *Selaginella* d) *Mucor*

462. Which of the following plant cells is not surrounded by a cell wall?
a) Root hair cell b) Stem hair cell c) Gamete cell d) Bacterial cell

463. Top-shaped multiciliate male gametes and the mature seed, which bears only one embryo with two cotyledons, are characteristic features of
a) Polypetalous angiosperms b) Gamopetalous angiosperms
c) Conifers d) Cycads

464. Gametophytic and sporophytic phases are independent in
a) Pteridophytes b) Bryophytes c) Gymnosperms d) Phaeophytes

465. Which has vascular tissue, produces spores, but does not has seeds?
a) Bryophyta b) Pteridophyta c) Gymnosperms d) Angiosperms

466. Blue-green algae has
a) Chlorophyll-*b* b) Xanthophyll c) *c* phycocyanin d) Fucoxanthin

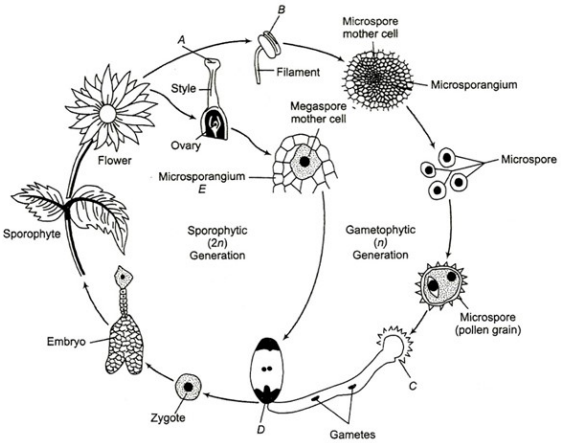
467. Which type of the rhizoids are present in *Riccia*?
a) Unicellular smooth b) Multicellular smooth
c) Unicellular smooth and tuberculated d) Multicellular smooth and tuberculated

468. Identify the alga, which exhibits diplontic life cycle.
a) *Spirogyra* b) *Chlamydomonas* c) *Fucus* d) *Volvox*

469. Gymnosperms are
a) Flowering plants
b) Seed bearing plants
c) Seedless flowering plants
d) Fruit bearing plants

470. Which of the following plant does not have *Rhizobium* containing root nodules?
a) *Phaseolus* b) *Pinus* c) *Pisum* d) *Cicer*

471. The diagram represents the life cycle of angiosperm. Choose the correct combination of labelling



a) A-Anther, B-Stigma, C-egg, D-Male gametophyte, E-ovule
b) A-Ovule, B-Stigma, C- Male gametophyte, D- Anther, E-Egg
c) A-Male gametophyte, B-Stigma, C-Anther, D-Egg, E-ovule
d) A-Stigma, B- Anther, C- Male gametophyte, D-Egg, E-ovule

472. Plants of this group are diploid and well adapted to extreme conditions. They grow bearing sporophylls in compact structures called cones. The group in reference is
a) Monocots b) Dicot c) Angiosperms d) Gymnosperms

473. After fertilisation the ovules develop into
a) Fruit b) Seed coats c) Seed d) Integuments

474. In comparition to pteridophyte, which one of the following algae exhibits diplontic life cycle?
a) *Volvox* b) *Chara* c) *Polysiphonia* d) *Focus*

475. Which one of the following plants functions as symbolic nitrogen-fixing plant?

a) *Azolla* b) *Cycas* c) Moss d) *Marchantia*

476. Which of the following is autotrophic?
a) Virus b) Mycoplasma c) *Nostoc* d) All of these

477. In some pteridophytes, sporophyll form distinct compact structures called ...A... in ...B... and ...C... Here A, B and C refers to
a) A-sporocarp, B-*Pogonatum*, C-*Selaginella*
b) A-spikelet, B-*Riccia*, C-*Marchentia*
c) A-strobilus, B-*Selaginella*, C-*Equisetum*
d) A-spike, B-*Fern*, C-*Salvinia*

478. *Kelp* (branched form) and *Sargassam* (filamentous form) belongs to
a) Green algae b) Brown algae c) Red algae d) Blue-green algae

479. In *Chlamydomonas*, the meiosis occurs in
a) Gamete b) Zygote c) Sporogonium d) Zoospore

480. Consider the following statements
I. The plants have magnificent property of retaining water. They can with hold water two hundred times more than their own weight. Hence, they are widely used by gardeners to keep cut plant parts moist during transportation and propagation
II. These plants grow as semiaquatic or submerged in acidic marshes. The older portions of plant die but do not decay due to peculiar germicidal properties
The above statements belongs to which of the following bryophitic plant?
a) *Pogonatum* b) *Funaria* c) *Sphagnum* d) *Marchantia*

481. First vascular plant is
a) Thallophyta b) Bryophyta c) Pteridophyta d) Spermatophyta

482. Female cone of *Pinus* is a
a) Modified needles b) Modified long shoot c) Modified dwarf shoot d) Modified scale

483. Algae include unicellular forms like ...A..., filamentous like ...B... and colonical forms like ...C... . Here A, B and C refer to
a) A-*Chlamydomonas*, B-*Volvox*, C-*Ulothrix*
b) A-*Ulothrix,* B-*Volvox*, C-*Chlamydomonas*
c) A-*Volvox*, B-*Ulothrix*, C-*Chlamydomonas*
d) A-*Chlamydomonas*, B-*Ulothrix*, C-*Volvox*

484. The gametophyte of moss is
a) Seta b) Capsule c) Zygote d) Protonema

485. In gymnosperms, the ovule is naked because
a) Ovary wall is absent b) Integuments are absent
c) Perianth is absent d) Nucellus is absent

486. Which of the following is not correctly matched?
a) *Chlamydomonas* - Unicellular flagellated b) *Laminaria* - Flattened leaf-like thallus
c) *Chlorella* - Unicellular non-flagellated d) *Volvox* - Colonial form, non-flagellated

487. Consider the following statements
I. Hydropterides are only plant among the heterosporous pteridophytes that are leptosporangiate
II. Heterosporous pteridophytes were the first land flora of earth
III. The difference in size between microspore and megaspore in *Seleginellakraussiana* is 1:200
IV. Female gametophyte of *Seleginella* mostly have single archenogium
Which of the above statement are correct?
a) I and II b) IV c) I, II and IV d) I, II, III and IV

488. Male sex organs in an angiospermic flower is
a) Stamen b) Pistil c) Carpel d) Shoot

489. Which of the following is an algal parasite?
a) *Volvox* b) *Ulothrix* c) *Porphyra* d) *Cephaleuros*

490. Mannitol is the stored food in

a) *Chara* b) *Porphyra* c) *Fucus* d) *Gracillaria*

491. Select the correct sequential arrangement of reproductive structures for pteridophytes
a) Sporophyll → Strobilli → Sporangia → Spore mother cell → Spores
b) Strobilli → Sporophyll → Sporangia → Spores
c) Spores → Sporophyll → Sporangia → Strobili
d) Spores → Sporangia → Sporophyll → Strobili

492. In gymnosperms, the seeds are naked because they lack
a) Integument b) Nucellus c) Pericarp d) Perianth

493. The relationship between the alga *Microcystis* and the surrounding fauna corresponds to
a) Ammensalism b) Parasitism c) Predation d) Exploitation

494. Bryophytes resemble algae in the following aspect.
a) Filamentous body, presence of vascular tissues and autotrophic nutrition
b) Differentiation of plant body into root, stem and leaves and autotrophic nutrition
c) Thallus like plant body, presence of roots and autotrophic nutrition
d) Thallus like plant body, lack of vascular tissues and autotrophic nutrition

495. Algae are also found in association with
a) Fungi b) Lichen c) Sloth bear d) Both (a) and (c)

496. The bryophytes are divided into
a) Mosses and liverworts b) Ferns and liverworts
c) Mosses and horse tails d) Ferns and horse tails

497. Consider the following statements
I. In red algae vegetative reproduction takes place by fragmentation
II. In red algae the food is stored as floridean starch, which is very similar to amylopectin and glycogen is structure
III. Cell wall of red algae consists of chitin
Which of the statements given above are correct?
a) I and II b) I and III c) II and III d) All of these

498. In *Selaginella*, trabeculae are the modification of
a) Epidermal cells b) Cortical cells c) Endodermal cells d) Pericycle cells

499. Which one of the following formed in *Spirogyra* is different based on its nucleus?
a) Zygospore b) Azygospore c) Aplanospore d) Akinete

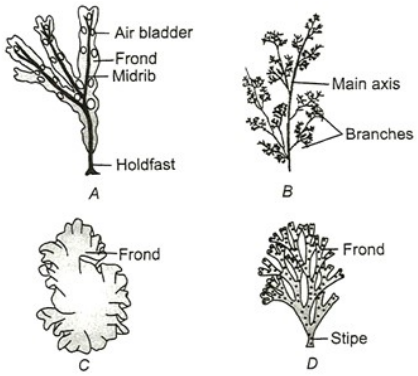
500. During development of embryo in archegonium of Bryophyta, its posterior part form protective embryo cover, which is called
a) Calyptra b) Paraphysis c) Apophysis d) Hypophysis

501. *Ectocarpus*, *Dictyota*, *Laminaria*, *Sargassum* and *Fucus* belongs to the class
a) Phaeophyceae b) Rhodophyceae c) Chlorophyceae d) Cynophyceae

502. Sexual reproduction in *Spirogyra* is an advanced feature because it shows
a) Morphologically differentiated sex organs b) Physiologically differentiated sex organs
c) Different sizes of motile sex organs d) Same size of motile sex organs

503. *Buxbaumia aphylla* is a classical example of
a) Parasitic bryophyte b) Saprophytic bryophyte
c) Symbiotic bryophyte d) Nitrogen fixing form

504. Identify the given figures of algae and select the correct option



a) A-*Volvox*, B-*Chlamydomonas*, C-*Chara*, D-*Porphyra* b) A-*Fucus*, B- *Polysiphonia*, C-*Porphyra,* D-*Dictyota*

c) A-*Fucus*, B-*Dictyota*,, C-*Porphyra*, D-*Polysiphonia* d) A- *Dictyota,* B-*Porphyra,* C-*Fucus*, D-*Polysiphonia*

505. Mosses and ferns are found in moist and shady places because both

a) Require presence of water for fertilization b) Do not need sunlight for photosynthesis

c) Depend for their nutrition on microorganisms, which can survive only at low temperature d) Cannot compete with sun-loving plants

506. Elater mechanism or spore dispersal is exhibited by

a) *Riccia* b) *Funaria* c) Liverworts d) *Marchantia*

507. Which of the following can be regarded as seedless vascular plants?

a) Angiosperms b) Gymnosperms c) Bryophytes d) Pteridophytes

508. Fern gametophyte shows …… nature.

a) Homothallic b) Fragmentation c) Heterothallic d) None of these

509. The peculiar feature of *Marchantia palmata* is

a) Absence of gemma cup b) Presence of androgynous receptacles

c) Absence of eaters d) All of the above

510. Chlorophyll-*a*, chlorophyll-*d* and phycoerythrin are characteristics of class

a) Phaeophyceae b) Xanthophyceae c) Chlorophyceae d) Rhodophyceae

511. Ramenta is the characteristic of

a) *Marchantia* b) *Funaria* c) *Dryopteris* d) None of these

512. Sperm of *Cycas* is

a) Multiflagellated and very large b) Small and biflagellated

c) Multiflagellated and small d) Large and biflagellated

513. Archegoniophore is present in

a) *Chara* b) *Adiantum* c) *Funaria* d) *Marchantia*

514. In *Pinus*, male cone bears a large number of

a) Ligules b) Anthers c) Microsporophylls d) Megasporophylls

515. Which one pair of examples will correctly represent the grouping spermatophyta according to one of the schemes of classifying plants?

a) *Rhizopus*, *Triticum* b) *Ginkgo*, *Pisum* c) *Acacia*, Sugarcane d) *Pius*, *Cycas*

516. Read carefully the following statements about pteridophytes

I. They are called vascular cryptogams

II. They produce spores rather than seeds

IIII. They are used for medicinal purposes

IV. They are used as soil binders

V. They are frequently grown as ornaments

Which of the statements given above are correct?

a) I, II and V b) II, IV and V c) II, III, IV and V d) I, II, III, IV and V

517. Corolloid roots are found in

a) Bryophytes b) Pteridophytes c) Gymnosperms d) Angiosperms

518. Leaf in young condition in fern is called

a) Scale leaf b) Sporophyll c) Circinateptyxis d) None of these

1 **(a)**
In pteridophytes, gametophytes (prothallus) require cool, damp and shady places to grow

2 **(a)**
Fern (Pteridophyta) and *Funaria* (Bryophyta) are on-seed producing plants, while *Ficus*and *Pinus* are seed producing plants.

3 **(d)**
Anthoceros is a hornwort (bryophyte) that harbours a nitrogen fixing blue-green algae (*Nostoc*) in its mucilage cavities. The association of *Nostoc* and *Anthoceros* is highly specialized form of symbiosis.

4 **(b)**
Gk. *Rhodo*-red; *Phyton*-plants. The characteristic red colour of algae is due to presence of excess amount of *r*-phycoerythrin (red in colour) which masks the colour of other pigments

5 **(b)**
The liverworts are widely distributed over the earth's surface but are far more numerous I the tropics than in other parts of the world. In India, they are abundant in the **Western Himalayas**, where rainfall is the heaviest.

6 **(a)**
In the alternation of generations the sporophytic generation is $2n$ and the gametophytic generation is n

7 **(c)**
All the chloroplast in the *Spirogyra* may be loosely or tightly coiled and run spirally in parallel. The band-shaped chloroplast is either narrow (having smooth margin) or broad (having serrated margin).

8 **(a)**
The leaves of *Selaginella* are microphillus. Each leaf is traversed by a single unbranched mid rib. A ligule arises from the base of each leaf (ligulate) they are delicate, green with entire or serrate margin and acute apex.

9 **(b)**
In *Dryopteris*, the mechanism of sporangium opening is effectively operated by **stomium**, when stomium ruptures the spores are discharged.

10 **(a)**
*Chara*possesses calcium encrustation and larvicidal properties.

11 **(a)**
Brown algae such as *Laminaria*, *Macrocystis*, *Fucus*,etc, are the main source of iodine.

12 **(b)**
In *Cycas*, the archegonia are foremed from the gametophytic cells lining the archegonialchamber. The number of archegonia formed in a gametophyte is variable, $e.g.$, $3-8$ in *C. revoluta*, $3-6$ in *C. rumphi* and $3-8$ in *C. circinalis*.

13 **(b)**
Leaf, calyptra and protonema all are haploid and have same number of chromosomes.

14 **(b)**
Angiosperms are so named because the are enclosed with in a fruit of some sort

15 **(a)**
Double fertilisation is the fusion of one male gamete with female gamete (syngamy) and other male gamete with diploid secondary nucleus (triple fusion), *i.e.*, double fertilisation = syngamy = triple fusion

16 **(d)**
Seeds of *Pinus gerardiana* (gymnosperm) are commonly known as chilgoza.

17 **(a)**
*Adiantum*is also called walking fern. In *Adiantum*, the tips of the leaves, on coming in contact with the soil, given out adventitious roots which, in turn, produce new leaves and develop into new plants.

18 **(c)**
The capsule bears spores. Spores are formed after meiosis

19 **(a)**
The antherozoids of *Dryopteris* are large, coiled and multiflagellate structures which have a prominent vesicle and a nucleus.

20 **(b)**

Pteridophytes are vascular cryptogams. They generally produce spores but do not have seeds.

21 **(a)**
A-**Haplontic** The dominant multicellular phase is gametophyte or haploid
B-**Diplontic** The dominant multicellular phase is diploid or sporophytic
C-**Haplo-diplontic** The dominant phase is both is gametophytic (multicellular) and sporophytic (multicellular)

22 **(c)**
Some bryophytes have important medicinal uses. For example- The tea prepared from *Polytrichum commune* is used to dissolve kidney and gall bladder stones. Species of *Sphagnum*, a moss, provide peat that have long used as fuel. Many chemical product such as alcohol, ammonium sulphate, peat tar, paraffin, nitrates, brown dye, tanning, materials, etc., can be obtained from peat

23 **(b)**
In moss, the sporophyte is differentiated into foot, seta and capsule. Capsule bears spores, which give rise to gametophyte after meiosis, *e*. *g*., *Funaria, Polytrichum* and *Sphagnum*

24 **(c)**
Unlike bryophytes and pteridophytes, in gymnosperms (*e*. *g*. , *Pinus*, *Cycas*, etc.), the male and female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.

25 **(d)**
The stems are unbranched in *Cycas* or branched in *Pinus* and *Cedrus*. In *Cycas* leaves reduced and usually once pinnate circinate. The male or female cones or strobili may be borne on the some tree *(Pinus*) or on different trees (*Cycas*). In *Cycas* the archegonia are embedded in the female gametophytes and open into the archegonia chamber

26 **(a)**
The members of brown algae have gelatinous coating outside the, cellulose cell wall called align. Alginic acid is a phycocollioid extracted commercially from giant brown algae or kelps. Alginic acid is copolymer of α-1, 4 D-mammuronic acid and α-1, 4 L-glucuronic acid

27 **(d)**
Adult plant body of bryophyta is called gametophyte. Gametophyte is haploid that produces gametes.

28 **(b)**
The main difference between algae and bryophytes is that the sex organs are single celled, without a jacket of sterile vegetative cells in algae, whereas in bryophytes sex organs are always multicellular and protected by a jacket of sterile vegetative cells.

29 **(b)**
A- *Cycas*, B-*Pinus*, C-*Ginkgo*

30 **(b)**
*Spirogyra*in an unbranched filamentous green thallophyte. The chloroplast is pigment containing organelle having chlorophyll—a and b. The yellow pigments are carotene and xanthophyll.

31 **(a)**
The cells of *Spirogyra* are longer than their breadth. The cell wall is two layered. The inner wall is made up of cellulose and outer of pectose, when pectose comes in contact with water it gives the filament slimy or slippery. Hence, the alga is called pond silk.

32 **(d)**
Polysiphonia and *Gelidium* are belongs to class-Rhodophyceae

33 **(b)**
In pteridophytes, the sporophyte consist of leaf-like appendages called sporophylls. Sporophyll in cluster form distinct compact structure called strobili or cones, *e*. *g*., *Selaginella*and *Equisetum*

34 **(b)**
In members of Chlorophyceae, meiosis is zygotic type.

35 **(d)**
In *Funaria*, apophyseal region is lowermost part of the capsule. The epidermis of the apophyseal region has stomatal apertures. Each stoma has two guard cells, which on later stages fuse to form a single annular guard cell.

36 **(b)**
Gymnosperms lack ovary thus, fruits are absent. They possess naked seeds due to presence of naked ovules

37 **(d)**
The vegetative plant body of *Marchentia* is a dorsiventral lobed thallus. The sporophyte of

bryophytes is known as sporogonium. The Sporogonium of *Marchentia* is differentiated into foot, seta and capsule. Asexual reproduction in *Marchentia* is takes place by the formation of gammae, which are located on the thalli

38 **(a)**
In Cyanophyceae many filamentous forms possess some specialized cells of disputed nature called **heterocysts**, which help in nitrogen fixation, *e. g.*, *Nostoc*, *Anabaena*, *etc*.

39 **(b)**
The reproduction in **mosses take place in water**, thus they occur in moist places.

40 **(a)**
Double fertilisation is characteristic feature of angiosperms. It was discovered by SG Nawaschin in 1898. In double fertilisation, one male gamete fused with ovum to form diploid zygote and the second male gamete fused with diploid secondary nucleus to form the triploid primary endosperm nucleus, which develops into endosperm. The endosperm provides, nutrition to the developing embryo

41 **(d)**
Male gametophyte bears antheridia, while female gametophyte bears archegonium, which produces, antherozoids and egg cell, respectively. Antherozoids are released in water, where it come in contact of archegonium and egg cell. It fuses with egg cell to produce the zygote. Zygote develops into young embryo

42 **(c)**
Peristome of *Funaria* sporophyte is involved in the dispersal of spores.

43 **(b)**
In bryophytes gametophytic phase is dominant, while in pteridophytes sporophytic phase is dominant

44 **(d)**
Gymnosperms lack ovary thus, fruits are absent. They possess naked seeds due to presence of naked ovules

45 **(d)**
In bryophytes the water is needed for
(i) Dehiscence of antheridia
(ii) Liberation of antherozoids
(iii) Transfer of sperms from antheridia to archegonia
(iv) Opening of archegonial neck
(v) The movement of antherozoids into the archegonial neck
Thus, due to peculiar type of their habitat, they are regarded as 'the amphibians of the plant kingdom'

46 **(a)**
In gymnosperms, the nucellus is protected by envelops and this composite structure called ovule. Each ovule is actually the female spore-producing organ surrounded by a protective envelope called integuments

47 **(c)**
*Pinus*belongs to **Coniferopsida**. The mature plant is large tree growing upto 30-70 m in height and differentiated into root, stem and leaves. Branches are arranged in acropetal order thus, giving the pyramid or conical shaped appearance to the tree.

48 **(c)**
Most algal genera are haplontic, some of them such as *Ectocarpus, Polysiphonia,* Kelps are haplodiplontic

49 **(a)**
Protein and starch.
Green algae store food in form of starch in specialized structures called pyrenoids located in chloroplast. Each pyrenoid has a central protein called 'pyrenocrystal' and a surrounding starch sheath

50 **(d)**
Due to the presence of *Trichodesmium*, a blue-green algae, 'red sea' have their specific red colour.

51 **(d)**
In *Funaria*, there are **32**peristomial teeth arranged in two rings of 16 each.

52 **(c)**
Gk; *Phaios* = brown, *Phyton* = plants, Phaeophyceae cell contains more than one parietal chromatophores. The chromatophores contain chlorophyll-*a* and c β-and α-carotenes and xanthophylls. Besides, they contain large amount of brown coloured xanthophyll-fucoxanthin, which masks the green colour of chlorophylls and that is why these algae appear brown in colour

53 **(b)**
In *Spirogyra affinis*, the sexual reproduction

occurs through conjugation (indirect lateral) in which adjacent cells of same filament conjugate, the protoplast of one cell (male gamete) migrates to the other (female gamete) then these protoplasts fuse to form zygospore which on germination forms, a single new filament.

Thus, from two adjacent filaments with 10 cells participating in reproduction 10 new filaments will be formed.

54 **(a)**
Liverwort (class-Hepatopsidae), any of more than 8000 species of small, non-vascular, spore-producing land plants constituting part of the division bryophytes

55 **(b)**
The cortex in coralloid roots of *Cycas* is divided into inner and outer regions by algal zone. The cells of this zone contain endophytic algal forms particularly
Anabaena cycadeae and *Nostoc punctiforme*.

56 **(c)**
Both (a) and (b).
In case of isogamy, the gametes can be flagellated and similar in size (in Chlamydomonas) or non-flagellated (non-motile) but similar in size (as in *Spirogyra*)

57 **(a)**
Polyembryony is of common occurrence among the gymnosperms. This is possible because more than one archegonia are fertilized and more than one zygote are formed. These develop into embryos but only one of them succeeds in developing into a complete embryo. In the conifers, there is a cleavage polyembryony. In this case, all the four cells of the young embryo separate and develop into four embryos, but only one completely develops and others abort, *e. g.*, *Pinus*.

58 **(a)**
The united protoplasmic mass of two gametes is called **zygospore** (zygote). Prior to germination, the diploid zygospore nucleus undergoes meiosis and forms four nuclei, three of these abort and only one is functional. It undergoes transverse division to give rise single filament.

59 **(b)**
Most of the members of the brown algae are marine, excepts three-*Pleurocladia*. *Heribaudiella* and *Bodanella*, which are found in freshwater

60 **(a)**
The coralloid root of *Cycas* is symbiotically associated with nitrogen fixing blue-green algae, *Anabaena cycadae* and *Nostoc puntiforme*. These blue green-algae (cyanobacteria) are prokaryotic photosynthetic and autotrophic.

61 **(b)**
Dominant phase in ferns is sporophyte, which is differentiated into root ($2n$), stem and leaf

62 **(c)**
In mosses only capsule bears spores, which gives rise to gametophyte after meiosis and the sporophyte in masses is more elaborate than that in liverworks

63 **(b)**
Asexual reproduction in *Marchentia* occurs by the formation of gemmae. The gemmae are multicellular green and biconvex lens shaped bodies produced in gemma cups. They detach from gemma cup and germinate to produce new plants

64 **(d)**
The tallest flowering plant in the world is swamp gum (*Eucalyptum regnans)* found in Australia's Southern Island state Tasmania. They grow upwards of 100-101 meters tall and are 405 cm in diameter

65 **(c)**
Fusion of a large non-motile egg or ovum with a smaller motile sperm (except in Rhodophyceae). The gametes differ morphologically as well as physiologically and are called oogametes. The fusion of gametes is called oogamy, *e. g.*, *Chlamydomonas*, *Fucus, Chara* and *Volvox*

66 **(d)**
In bryophytes the diploid sporophyte is short lived and dependent upon the gametophyte

67 **(b)**
*Nephrolepis*is a pteridophyte.

68 **(b)**
The club mosses (division-Lycophyta) are now limited to representatives a few centimeters in height. Their leaves are small and scale like, resembling the leaf like structures of mosses. Club mosses of the genus—*Lycopodium*, commonly known as ground pine, form a beautiful ground cover in some temperate coniferous and

deciduous forests.

69 **(b)**
In case of isogamy, the gametes can be flagellated and similar in size (in *Chlamydomonas*) or non-flagellated (non-motile) but similar in size (as in *Spirogyra*)

70 **(a)**
*Ginkgo*shows resemblance with bothCycadales and Coniferales. Resemblanes between *Ginkgo* and Cycadales are well-developed nuellar beak and pollen chamber, haustorial nature of pollen tube, multiflagellated spermatozoids, large egg, massive female gametophyte with well-developed venter, endoscopic embryo with two cotyledons, hypogeal seed germination.

Its resemblance with Coniferales are cone like appearance, long and dwarf shoots, pycnoxylic wood, uniseriatemedullary rays, longitudinal dehiscence of microsporangia and sessile ovule, etc.

71 **(b)**
Though bryophytes are the land plants but water is essential for fertilization. It provides a medium of transport for antherozoids to reach archegonia. Hence, bryophytes are called amphibians of plant kingdom.

72 **(a)**
Female sex organ is carpel also known as pistil or gynoecium. It consist of three parts style, stigma and ovary

73 **(b)**
Sago is obtained from the pith of *Cycas circinalis* and *Cycas revoluta*. It is rich in starch and used as constituent of poor man's food.

74 **(c)**
Artificial system of classification was given by Linnaeus and based on morphological characters such as habit, colour, number and shape of leaves, etc

75 **(c)**
The members of brown algae called sea weeds or kelps are the main source of **iodine**, *e. g.*, *Laminaria*, *Macrocystis* and *Fucus*.

76 **(d)**
Different systems of classification proposed from time to time have been divided into three basic categories, *viz.*, artificial systems, natural systems and phylogenetic systems

77 **(c)**
Laminaria is the example of class-Phaeophyceae. In this case, the plant body is usually attached to the substratum by a holdfast and has a stalk, the stripe and leaf like photosynthetic organ the frond

78 **(d)**
In isogamy, gametes are morphologically and physiologically same, in anisogamy gametes are morphologically different but physiologically same and in oogamy, gametes are both morphologically and physiologically different, *eg*, *Ulothrix* and *Spirogyra* members of Chlorophyeae.

79 **(a)**
Ciliated antherozoids and necessity of water for fertilization suggest that the bryophytes have originated from aquatic ancestors.

80 **(c)**
In gymnosperms the primary root commonly grows to become a thick central root, the tap root, which may or may not have thick lateral roots (branches)

81 **(d)**
In class-Chlorophyceae, the cells possess one or more chloroplasts. *The shape ofchloroplasts may be*
Cup-shaped – *Chlamydomonas*
Girdle-shaped – *Ulothrix*
Spiral - *Spirogyra*
Star-shaped – *Zygnema*
Reticulate – *Chlamydomonas reticulata*
Partial reticulate – *Oedogonium*
Partial band-shaped – *Hydrodictyon*
Disc-shaped - *Chara*

82 **(b)**
Some of the pteridophytes produce smaller spores called microspores and larger one called megaspore. This nature is called heterospory. In angiosperms there is only one functional megaspore. The male and female gametes fuse to form zygote which eventually developes into embryo. The embryo forms the seed.

83 **(d)**
Algae are predominantly aquatic occur both in marine as well as freshwater habitats. Some are terrestrial and grow in moist places. Some algae

grow under very special environmental conditions such as hot water springs (thermal algae), ice and snow (cryophytes), on surface of other plants (epiphytes) and animals (epizoophytes) and in symbiotic association (lichen)

84 **(b)**
Pteridophytes are considered as first terrestrial plants to possess vascular tissues xylem and phloem. All the vegetative parts possess vascular tissues (*i.e.*, xylem and phloem) organised in definite groups

85 **(c)**
Vaginula is the part of venter of archegonium left at the base of seta. It is haploid in nature.

86 **(a)**
*Sphaerocarpus*belongs to order-Sphaerocarpales (Bryophyta).

87 **(b)**
Two synegirds and one egg cell.
Polygonum type of embryo sac is the most common in angiosperms. It is 7-celled and 8-nucleate. The nuclei are arranged in such a way that three organized at micropylar end and form egg apparatus (one egg and two synergides,) two nuclei migrate to centre and form polar nuclei in a single central cell and three nuclei at chalazal pole organized into antipodal cells

88 **(d)**
In *Dryopteris*, meiosis takes place during spore formation.

89 **(d)**
*Pinus*is a gymnospermic plant. Ovulves of *Pinus* are uncovered, which lie on the megasporophyll, hence this plant does not have flowers. However it produces seeds (from ovule after fertilization) like other three plants mentioned, all of the other three are angiosperms.

90 **(d)**
The double fertilisation was discovered by SG Nawaschin (1898) and Guignard in *Lilium* and *Fritilaria*. Double fertilisation is restricted only to angiosperms. When pollen tube enters ovule, it strikes one of the synergids and burst open to release the two male gametes, which fuse with two different structures in the same female gametophyte. Thus, double fertilisation can be distinguished as.
(i) **Generative Fertilisation** Fusion of one male gamete with the egg producing diploid zygote or oospore
(ii) **Vegetative Fertilisation** Fusion of nucleus of second male gamete with the diploid secondary (fused) nucleus or the triple fusion, *i.e.*, fusion of one male nucleus and two polar nuclei forming endosperm ($3n$)

91 **(b)**
The presence of vessels in the xylem and abserce of archegonis are angiospermic character and also found in *Gnetum*.

92 **(a)**
Medicine ephedrine is obtained from several species of $Ephedra$ of family-Ephideraceae. It is used in the treatment of respiratory disorders like cold, asthma, bronchial congestion.

93 **(a)**
The antheridial branch of $Funaria$ is called male flower.

94 **(d)**
Gymnosperms ($Gymno$ = naked; $sperma$ = seed) are naked seeded plants, in which ovule is not covered by ovary. In gymnosperms, xylem contains only tracheids and xylem parenchyma; vessels are absent (exceptionally present in Gnetales).

95 **(c)**
Chlorella is used for purifying air in space ships. It is also used as food supplements by space travellers

96 **(b)**
The cones bearing megasporophyll with ovules are called female strobili or megasporangia or macrosporangiate. Both megasporophyll and microsporophyll may be present on same plant ($e.g.$, *Pinus*) or may be present separately

97 **(b)**
In *Spirogyra* the gametophytic stage is dominant and sporophyte is single celled zygote

98 **(b)**
In all cycads except the genus *Cycas*, the ovules are borne on megasporophylls in megastrobili, in *Cycas* the ovules develop on individual leaf-like megasporophylls in what is regarded as a primitive arrangement. The microspores of all cycads develop into microstrobili

99 **(a)**

Red algae secrete and deposit calcium carbonate and appear like corals.

100 **(c)**
Pteridophytes are vascular, spore forming non-seed forming, non-flowering plants. The phloem of pteridophytes does not contain companion cells. Presence of **companion cells** is the characteristic feature of angiospermic phloem.

101 **(c)**
Zoospores.
Algae produce different type of spores, the most common being the zoospores, asexually. These are motile, flagellated and give rise to new plant on germination

102 **(d)**
The ovules of gymnosperms are unitegmic (apparently bitegmic in *Gnetum*). The integument is three layered. In gymnosperms, the ovules are freely exposed before and after fertilization, *i. e*., they are not enclosed by an ovary wall.

103 **(a)**
A-Synergids, B-Polar nuclei, E-Central cell, D-Antipodal cells, E-Filiform apparatus, F-Egg cell
Polygonum type of embryo sac is 7-celled 8-nucleate, *i.e*., composed of 3 antipodals, 2 synergid, one egg and one central cell

104 **(b)**
Agar, one of the commercial products obtained from *Gelidium* and *Gracilaria* is used to grow microbes and in preparation of ice-creams and jellies

105 **(a)**
Polysiphonia is the example of class-Rhodophyceae. It is red algae. The characteristic red colour of algae is due to presence of excess amount of *r*-phycoerythrin

106 **(a)**
Protonema is prostrate, branched, multicellular, filamentous structure, which bears erect foliose gametophore. Protonema is produced on germination of a moss (bryophyte) spore, from which new plants develop as buds.

107 **(d)**

Group	Major Pigment	Reserve Food
Chlorophyceae	Chlorophyll – *a, b*	Starch
Phaeophyceae	Chlorophyll – *a, c*	Laminarian, mannitol
Rhodophyceae	Chlorophyll – *a, d*	Floridean starch

108 **(a)**
Algae is a group of chlorophyll bearing, photosynthetic, autotrophic, thalloid plants. Except a few, all the algae are aquatic. The algae reproduce by vegetative, asexual and sexual means. *Ulothrix* is a filamentous algae and *Volvox* is in colonial form

109 **(c)**
In angiosperms, the pollen grains and ovules are produced in special structure called flower

110 **(c)**
The members of class-Chlorophyceae are commonly called green algae. Their cells possess one or more chloroplasts. Photosynthetic pigments in chloroplasts are chlorophyll-*a*, Chlorophyll-*b*, carotene and xanthophylls. The green colour is due to presence of excess of chlorophyll. Chloroplastic pigments are the same as in the land plants

111 **(d)**
Crude turpentine (oleoresin) is obtained from the long leaf of pine (*Pinus australis*) and slash pine (*P. caribaea*). pine resin is obtained from chir pine (*Pinus roxburghii*) and blue pine (*P. wallichiana*) by tapping.

112 **(c)**
In *Cyas*, pollination occurs at three called stage. Microspore is sheded from the microsporangium at three-celled stage, *i. e*., prothallial cell, tube cell and generative cell.

113 **(b)**
*Sphagnum*is bryophyte, commonly called as bog moss or peat moss. It is hygroscopic and possesses a remarkable water holding capacity. Hence, it is used as a packing material in the transportation of flowers, live plants, tubers, bulbs, seedlings, etc. It is also used in seedbeds and in moss-sticks.

114 **(c)**
In the angiosperm ovule, central cell of the embryo sac prior to the triple fusion, contains two haploid polar nuclei. Triple fusion in angiosperm is the fusion of second sperm with two polar nuclei or the secondary nucleus, which results in the formation of a triploid primary endosperm

nucleus

115 **(d)**
The haploid gametophyte is dominant, long lived, green and independent whereas the diploid sporophyte is short lived and dependent upon the gametophyte

116 **(b)**
In *Cycas*, the leaves are of two types, *i*. *e*., scale leaves and foliose leaves. Foliose leaves are large, compound and pinnately divided into many leaflets. Leaflet is sessile, straight, linear-lanceolate.

117 **(a)**
The pteridophytes are flowerless, seedless, spore producing vascular plants which have successfully invaded the land. These are called vascular cryptogams because among cryptogams the vascular strands are present only in pteridophytes.

118 **(a)**
A-Sporophyte B-Haploid microspore C-Haploid megaspore
In gymnosperms the dominant phase is sporophyte. They are neterosporous and produce haploid megaspore and microspores. Which are produced with in sporangia born on sporophyll. These sporangia are arranged spirally along an axis to form compact cones

119 **(c)**
The plant body of algae is called thallus. The thalli of algae show a great variation of forms. Algae are photoautotrophic in their mode of nutrition. They perform photosynthesis due to presence of chlorophyll in their chloroplasts or chromatophores

120 **(c)**
All statements belong to class-Rhodophyceae

121 **(a)**
In gymnosperms the dominant phase is sporophyte, gymnosperms are heterosporous produced haploid megaspore and microspores, which are produced with in sporangia born on sporophyll. These spore bearing plants are called sporophytes

122 **(a)**
Liverworts reproduce asexually by the formation of specialised structure called gemmae or through fragmentation of thalli. Gemmae are asexual buds, which originate from small receptacles called gemma cups

123 **(d)**
Bryophytes are also known as amphibians of plant kingdom. They have various features, which enabled them to live on both land and on water habitats

124 **(b)**
Professor **M O P Iyenger** is know as **father of Inidan phycology**. Phycology is the study of algae (chlorophyllous thallophytes).

Professor **K C Mehta** worked on cause behind annual recurrence of wheat rust (fungi, *i*. *e*., non-chlorophyllous thallophytes) in plains of northern India.

125 **(a)**
Sago starch is obtained from *Pinus*

126 **(c)**
The primary endosperm nucleus is triploid ($3n$) as it is the product of triple fusion

127 **(c)**
A-Antheridiophore, B-Archegoniophore, C-Gemma cup

128 **(a)**
Genera like *Selaginella* and *Salvinia*, which produce two kinds of spores, macro (large) and micro (small) spores are known as heterosporous

129 **(c)**
Pinus is either monoecious or dioecious. In monoecious condition male and female strobili are present on same plant and dioecious condition male and female strobili are present on different plant. *Cycas* have only dioecious condition

130 **(a)**
Agar (agar-agar) is polymer of D-galactose 3-6 anhydro L-galactose having sulphateesterification after tenth galactose unit.

131 **(a)**
Gymnosperms are naked seeded plants because seeds are presents on the megasporophyll and are not enclosed with fruit wall due to lack of ovary wall.

132 **(c)**
A-*Dictyota*, B-*Polysiphonia*, C-*Porphyra*, D-*Laminaria*, E-*Fucus*

133 **(a)**
Filament and anther.
Male sex organ is stamen also known as

androecium. It consists of an anther lobe and a filament. Anther produces pollen grains

134 **(c)**
Cycas are heterosporous and in additions, produce highly specialised complex reproductive and dispersal structure called seeds. *Cycas* is also a dioecious plant. Dioecius plants are unisexual, having male and female reproductive organs on different individual (plants)

135 **(b)**
Chilgoza a gymnospermic seed that is eaten as dry fruit is produced by *Pinus* gerardiana

136 **(a)**
In moss (*Funaria*), the dispersal of spores is facilitated by hygroscopic pouring movements of peristomial teeth (lengthening and shortening of peristomial teeth). The inner peristome acts as a sieve allowing only few spores to escape at a time.

137 **(b)**
Bryophytes lack true-roots, stem or leaves. They possess root-like, leaf-like or stem-like structures

138 **(a)**
In *Cycas*, ovules are found without ovary, this condition is called naked ovule. *Cycas* produces largest ovules in the plant kingdom. The ovules are orthotropous and unitegmic.

139 **(c)**
Maiden hair fern, the common name given to the fern *Adiantum capillus veneris*, in which leaves are bi-pinnate with sori (clustered stalked sporangia) present sub-marginally.

141 **(a)**
The members of Myxophyceae or Cyanophyceae are commonly known as blue-green algae due to the presence of blue-green pigment –phycocyanin, c −phycoerythrin alongwith chlorophyll $-a$, β −carotene and myxoxanthin.

142 **(c)**
In *Pinus*, the microspore nucleus divides by a periclinal wall and forms a very small prothallial cell and large central cell. The central cell cuts off a second prothallial cell and antheridial cell. The nucleus of the antheridial cell divides to form generative cell and tube cell. Thus, the pollen grain of *Pinus* is sheded at four-celled stage when it consists of two vegetative prothallial cells, a generative cell and a tube cell.

143 **(c)**
Class-Phaeophyceae includes brown algae. Brown algae are marine plants. Chief pigments found in the members of this class are chlorophyll−a and c, β − carotene, violaxanthin, fucoxanthin, lutein anddiatoxanthin. Reserve food is laminarian, mannitol and oils.

144 **(a)**
Haploid spore germinates to form a prothallus (gametophyte), which is monoecious, *i.e.*, has both antheridia (♂)and archegonia (♀)

145 **(d)**
Gymnosperms include medium sized trees or tall trees and shrubs. One of gymnosperms, the gaint red wood tree *Sequoia* is one of the tallest trees species

146 **(b)**
The spores are homosporous and germinate to produce independent cushion-like monocious gametophyte

147 **(a)**
A- *Marchentia* (male thallus)
B- *Marchentia* (female thallus)
C- *Funaria*
D- *Sphagnum*

148 **(a)**
Pollen grains.
Male sex organ is stamen also known as androecium. It consists of an anther lobe and a filament. Anther produces pollen grains

149 **(d)**
The only positive evidence of aquatic ancestry of bryophyte is ciliated sperms. Each sperm usually consists of minute, slender, spirally curved body furnished with two long, terminal whiplash type flagella

150 **(c)**
Heart-shaped prothallus is a gametophytic stage of fern. It contains male and female reproductive organs, so it is a monoecious structure.

151 **(d)**
Heterocysts are specialized cells found in blue-green algae like
Nostoc, *Anabaenopsis*, *Anabaena*, *Rivularia*,
Aulosira, *Scytonema*, etc.

152 **(c)**
Chemotaxonomy.

Numerical taxonomy which is now easily carried out using computers is based on all observable characteristics. Number and codes are assigned to all the characters and the data is then processed. In this way each character is given equal importance and at the same time hundreds of characters can be considered

153 **(a)**
The vegetative plant body of *Marchantia* is a dorsiventral lobed thallus. It is dichotomously branched. The upper surface is smooth whereas the lower surface bears a large number of unicellular rhizoids, which penetrate into the soil

154 **(a)**
Study of algae is known as **Phycology** while study of fungi is known as **Mycology.**

155 **(d)**
All statements are correct.
Sexual reproduction in bryophytes is oogamous type. The gametes are produced in complex, multicellular jacketed sex organs. The male reproductive organs area antheridia and female reproductive organs are archegonia.
The haploid gametophytes is dominant, long-lived, green and independent whereas the diploid sporophyte is short lived and dependent upon the gametophyte

156 **(d)**
The blue-green algae are prokaryotic and unicelled to filamentous. They have the chief photosynthetic pigments as chlorophyll $-a$, $\beta -$ carotene, myxoxanthin, lutein, $c -$ phycocyanin, $c -$ phycoerythrin andallophycocyanin.

157 **(d)**
Structural embryology, phytochemistry, anatomy. Natural system of classification was developed by George Bentham and Joseph Dalton Hooker based on natural affinities among the organism. It was based on both external and internal features like phytochemistry, anatomy, ultra-structure, embryology

158 **(c)**
*Dawsonia*is the largest bryophyte (moss), which grows up to 70 cm. It is found in New Zealand and Australia.

159 **(d)**
Dryopteris, *Pteris* and *Adiantum* belong to class-Pteropsida of the division - Pteridophyta

160 **(b)**
*Cycas revoluta*is popularly known as **sago palm**. Sago (sabodana) is a starch obtained from stems and seeds of various species of cycads.

161 **(b)**
Pteridophytes are called vascular cryptogams because among cryptogams the vascular strands are present only in pteridophyte. All the vegetative parts possess vascular tissues (*i.e.*, xylem and phloem)

163 **(c)**
*Sphagnum*is employed for gauze to dress wounds and peat deposits are cut into blocks, dried and used as fuel.

164 **(c)**
Among plant imbibantsphycocolloids, *e*. *g*., Agar-agar are the best imbibants followed by protein, starch and cellulose.

166 **(a)**
Types of pigments present in the cell of algae is the most important character for classification.

167 **(d)**
Eichler (1883) divided plant kingdom into two sub-kingdoms.

Cryptogamae Plants having no flowers such as algae, fungi, bryophytes and pteridophytes.

Phanerogamae Plants having evident reproductive organs like flowers and seeds such as angiosperms and gymnosperms.

168 **(a)**
Calyptra is a small sheath of cells, derived from the archegonia, which covers top of the capsule.

169 **(b)**
A-Meiotically; B-Four
In gymnosperm megaspore differentiate to give rise to composite structure called ovule. Megaspore mother cell divides meiotically to give rise four haploid megaspores

170 **(a)**
In *Cycas*, archegonia are present, while antheridia remain absent. In ferns and mosses, both archegonia as well as antheridia are present.

171 **(b)**

In angiospermic plant pollen grain reaches to embryo sac after its germination on stigma and through pollen tube

172 **(b)**
In bryophytes, gametophytic plant body is dominated over sporophytic. Sporophytes are depend on gametophytes. Bryophytes like *Polytrichum* have largest gametophyte.

173 **(a)**
Old pine (*Pinus*) stumps are still being distilled to some degree as a source of turpentine and resin.

174 **(c)**
During formation of male gametes from pollen grains, the ratio of equatorial division that takes place in *Cycas* and angiosperms is 2 : 1 respectively.

175 **(d)**
In moss, the sporophyte is differentiated into foot, seta and capsule

176 **(c)**
Sexual reproduction involves the formation of gametes and their fusion during the process called fertilisation. Depending upon the structure and behavior of gametes, there are different types of sexual reproduction. *These are*
(i) **Isogamy** Fusion of morphologically alike gametes which look and behave similarly is called isogamy
(ii) **Anisogamy** Fusion of morphologically dissimilar gametes, which may be motile or non-motile
(iii) **Oogamy** Fusion of a large non-motile egg or ovum with a smaller motile sperm (except in Rhodophyceae). The fusion of gametes is called oogamy

177 **(d)**
Sexual reproduction I *Spirogyra*takes place by conjugation. Scalariform conjugation occurs between the cells belonging to different filaments. Hence, these species are heterothallic. Lateral conjugation is primitive than scalariform conjugation.

178 **(d)**
An ideal embryo sac contains 7-cells and 8-nuclei. 3 cells are present at the micropylar end and form egg apparatus, mid of which forms egg cell and rest two lateral form synergids. One cell present in the centre of embryo sac, known as central cell and contains two nuclei and rest three cells are present at chalazal end for antipodal cells

179 **(a)**
During fertilisation in plants, one male gamete fuses with the egg cell and forms the zygote (this process is called syngamy). The other male gamete fuses with the secondary nucleus (this is called triple fusion). The syngamy and triple fusion together are called double fertilisation

180 **(b)**
Style, stigma and pistil.
Female sex organ is carpel also known as pistil or gynoecium. It consist of three parts style, stigma and ovary

181 **(c)**
Division- Angiospermae is sub-divided into two classes.
Class-Dicotyledonae and Monocotyledonae
Monocot have one cotyledon whereas dicot have two cotyledons

182 **(d)**
*Pinus*is**heterosporous**. The sporogenesis results in the formation of micro and megaspores representing the first gametophyte cells.

184 **(a)**
Calyptra is a covering developed from the ventre of archegonium in bryophytes and pteridophytes. It acts as a transpiration shield around the immature capsule and provides protection to the young capsule.

185 **(b)**
Species of *Sphagnum*, a moss, provides peat (fuel)

186 **(d)**
Sexual reproduction in *Spirogyra* is accomplished by conjugation, which involves the fusion of two morphologically identical but physiologically dissimilar gametes. The conjugation is of two types-lateral and scalariformconjugation. Lateral conjugation is rarely found and takes place between two adjacent cells of same filament (*i. e.*, homothallic species).

187 **(c)**
Gymnosperms are divided into three classes, *i. e.*, Coniferopsida, Cycadopsida and Gnetopsida. Lycopsida and Pteropsida are related with pteridophytes, while Bryopsida is related to bryophytes.

188 **(a)**
Haploid endosperm is formed only in *Cycas* while apogamy is found only in *Pteris*.

189 **(d)**
Brown algae (*Laminaria*) are rich in sodium, potash and iodine. About 7% of total world production of iodine is obtained from kelps in Japan.

190 **(d)**
Algae reproduce by vegetative, asexual and sexual methods. The vegetative and asexual methods are abundant. Algae reproduce vegetatively by fragmentation and asexually by means of motile or non-motile spores. Sexual reproduction occurs through fusion of two gametes

191 **(d)**
In brown algae, sexual reproduction is isogamous (in *Ectocarpales*), anisogamous (in *Cutleriales*) and oogamous (in *Fucus, Laminaria, Dictyota*, etc). In most of the brown algae, the gametes are pyriform form and flagellated. Fertilisation is external, *i.e.*, the gametes fuse outside the gametangia in water

192 **(c)**
*Sphagnum*is commonly called as 'bog moss' or 'peat moss'.

193 **(a)**
In *Equisetum*, the anterior part of the antherozoid (sperm) is spirally coiled and has numerous flagella, whereas posterior part is somewhat expanded. The sperms of*Lycopodium*, *Riccia* and *Anthoceros* are biflagellated.

194 **(c)**
Angiosperms are divided into two classes dicotyledons and monocotyledons.
Dicotyledons have two cotyledon in their seed and monocotyledon have one

195 **(a)**
*Cycas*seed is **dicotyledonous** and **endospermic**.
In *Cycas*, fleshy female prothallus is called endosperm, which function as a food storage region of the seed.

196 **(c)**
In bryophytes each sperm usually consists of minute, slender, spirally curved body furnished with two long, terminal whiplash type flagella.
The sperms are liberated from antheridia, swim in a film of water and attracted towards the archegonium. They enter into the archegonia and fertilise the egg and form zygote. Zygotes do not undergoes reduction division immediately. They produce a multicellular body called a sporophyte

197 **(d)**
Dryopteris, *Pteris*and *Adiantum*belong to class-Pteropsida of the division-Pteridophyta.

198 **(a)**
The 13-celled microspore of male gametophyte in *Selaginella* is sheded from microsporagium, which is having 1-prothallial cell + 8-jacket cells +4-androgonial cells (i.e., 8+4=12 antheridial cells).

199 **(b)**
In haplontic life cycle gametophyte is dominant and sporophyte is single celled zygote. Haplonts are
(i) Most fungi
(ii) Some green algae, *e. g.*, *Chlamydomonas*
(iii) Many Protozoa, *e. g.*, *Plasmodium*

200 **(a)**
Carrageenin is obtained from *Chondrus*.

201 **(b)**
In ferns about 32 multiflagellate, spirally coiled sperms are produced in antheridium. These sperms swim towards open archegonia due to the presence of malic acid in the later, *i. e.*, they show chemotaxy.

202 **(b)**
*Pinus*is monoecious, which bear male cone as well as female cone on the same tree at separate branches.

Marchantia, *Cycas*and papaya are dioecious plants.

203 **(d)**
Endosperm in a gymnospermic plant is a haploid structure, which is formed without fusion of gametes and represent female gametophyte. Leaf of gymnosperm belongs to diploid generation. $2n = 16, n = 8$.

So, number of chromosomes in endosperm of gymnosperm will be 8.

204 **(b)**

The green algae *Cephaleuros virescens* causes red rust of tea, thus, destroying the tea leaves. Similar disease is caused by the species of *Cephaleuros* to coffee plant, piper and *Citrus* species.

205 **(b)**
Blue-green algae or cyanobacteria have prokaryotic organization. There is no true nucleus and membrane bound cells organelles like mitochondria, chloroplasts, ER, Golgi body, etc, in prokaryotic cell. The DNA of prokaryotic cells lack histone proteins.

206 **(a)**
Pollination occurs once a genetically compatible pollen grain lands directly on the ovule. The pollen grain germinate and grows into the ovule, penetrating the female gametophyte and eventually fertilising an egg nucleus

207 **(c)**
The sporophyte of *Funaria* consists of a foot, a long slender seta and a capsule. The capsule wall is several layers thick and is highly differentiated. The outermost layer is the epidermis which contains numerous stomata in the apophysis region, fewer in the theca region and none in the opercular region.

208 **(b)**
Bacillariophyceae - Golden brown algae (diatoms)

Chlorophyceae - Green algae

Xanthophyceae - Yellow-green algae

Phaeophyceae - Brown algae.

209 **(a)**
Gametophyte is gamete bearing, haploid multicelled stage of many plants, beginning with haploid spores and ending at fertilisation

210 **(b)**
A-*Selaginella*, B-*Equietum*, C-Fern, D-*Salvinia*

211 **(b)**
Pollen grain from anther after dispersal reaches to the stigma of ovary with the help of various agents like wind, air, insects. This process is known as pollination

212 **(a)**
Ephedra (gymnosperm) is a bushy trailing shrub. Drug ephedrine is obtained from *Ephedra*. This drug is used in curing respiratory ailments including asthma.

213 **(d)**
In *Spirogyra*, sexual reproduction occurs through conjugation resulting into the formation of zygospore, while in *Funaria*, *Pteris* and *Cycas* zooidogamous oogamy occurs.

214 **(a)**
A-*Funaria*-Moss; B-*Sphagnum*-Moss

215 **(b)**
The smallest flowering plant in the plant kingdom is aquatic. It is *Wolffia*, commonly known as water meal or duck weed

217 **(c)**
Funari, Polytrichum and *Sphagnum* are the examples of mosses

218 **(d)**
The pollen sac in *Cycas* is called **microsporangium**. Each mature microsporangium is an oval body attached by a short stalk at one end. It produces a large number of microspores (pollen grains).

219 **(a)**
The apophysis of moss **capsule** contains chloroplast bearing parenchymatous cells, called as chlorenchyma. Due to presence of chloroplasts, chlorenchyma cells have the ability to prepare food by the process of photosynthesis.

220 **(c)**
Bryophytes are dependent on water for reproduction, because sperms must swim to the archegonia. They are partly adapted to the land, because the gametes develop in protective structures, *i.e.*, antheridia and archegonia. So, bryophytes are also called 'amphibians of the plant kingdom'

221 **(a)**
Phylogenetic system of classification was given by Engler and Pranti based on evolutionary relationship of organism. It is also known as Hutchinson's system

222 **(c)**
Cyanobacteria (blue-green algae) were first photosynthetic organisms. They contain photosynthetic lamellae equivalent to thylakoids hence, these are autotrophic.

223 **(d)**

In bryophytes, the most conspicuous phase in life cycle is the gametophyte. It is independent and concerned with reproduction. In *Sphagnum*, male and female gametophytes are independent and free living.

224 **(a)**
Chlamydomonas, Volvox, Ulothrix, Spirogyra and *Chara* are the examples of class-Chlorophyceae

225 **(d)**
Agar is obtained from *Gelidium, Gracilaria, Chondrus, Ceramium*, etc., and used in microbiological works to solidify culture media. Green unicellular algae such as *Chlorella* and *Chlamydomonas* are used in sewage disposal ponds. They remove CO_2 and restore O_2 by the process of photosynthesis and make the sewage water enhitable for many fishes and aerobic bacteria. *Porphyra Laminaria* and *Sargassum* are used as food

226 **(b)**
The multicellular female gametophyte is retained with in megasporagium

227 **(c)**
*Anthoceros*belongs to class-Anthocerotopsida of division-Bryophyta.

228 **(d)**
From the pith of *Cycas revoluta* sago (starch) is obtained, while the seeds of *Cycas rumphi* and shoots of *Cycas pectivaler* and *Cycas circinalis* are cooked and eaten as a source of starch by tribals in India. Some species of *Cycas* are grown as ornamental plants.

229 **(b)**
Endosperm in angiosperms develops as a fusion product of secondary nucleus with male gamete. Secondary nucleus is diploid structure formed by fusion of haploid chalazal polar nucleus and haploid micropylar polar nucleus. Zygote is formed by the fusion of male gamete with egg

230 **(c)**
The microsporophyll is a brown coloured triangular structure consisting of a short stalk or filament and leaf like flattened structure or 'anther'. Each sporophyll is provided with two microsporangia on its abaxial surface.

231 **(c)**
*Chlorella*is used for purifying air in space ships.

232 **(d)**
Pteridophytes are called vascular cryptogams, also known as seedless vascular plants. They produce spores rather than seeds. These include horse tails and ferns

233 **(a)**
Pyrenoids are centrally placed protein bodies surrounded by starch sheath, which are present in chloroplast in the leaves of *Funaria*.

234 **(c)**
Bryophytes mostly occur in humid damp and shaded localities. The bryophytes are widely distributed throughout the world, especially in moist mountain forests of tropics, sub-tropics and Antarctic regions

235 **(a)**
The unicelled microspore of *Pinus* undergoes three divisions of microgametogenesis, so as to form a four celled pollen grains or male gametophyte. There are two prothallial cells, a generative cell and a tube cell.

236 **(b)**
A-Capsule, B-Seta, C-Sporophyte, D-Gametphyte

237 **(d)**
Member of Chlorophyceae are unicellular, colonial or filamentous have definite chloroplast commonly known as green algae

238 **(b)**
Corolloid root is developed in *Cycas*. It contain an algae zone in the cortex. This algal zone contains blue-green algae (cyanobacteria) like *Nostoc*, *Anabaena*, which grow in symbiotic association with corolloid root

239 **(c)**
Natural system of classification was developed by George Bentham and Joseph Dalton Hooker based on natural affinities among the organism. It was based on both external and internal features like phytochemistry, anatomy, ultra-structure, embryology

240 **(a)**
The major difference between angiosperms and gymnosperms is found on the seed. This is where angiosperm seeds are coated with in the fruits. While on the other hand, gymnosperm seeds are exposed

241 **(d)**
In gymnosperms the sporophytic phase is dominant and the gametophytic phase is

dependent on sporophyte.

242 **(a)**
In angiosperm, pollen grain reaches to embryo sac after its germination on stigma and through pollen tube. Pollen tube carries two male gamete and discharge it into embryo sac

243 **(c)**
Selaginella bryopteris is commonly called **sanjeevani booti.**

244 **(b)**
In *Dryopteris* (pteridophyte), the sporophytic phase is independent and autotrophic, whereas in *Funaria* (bryophyte), the sporophytic phase is dependent on gametophytic phase.

245 **(d)**
Retort cells occur in *Sphagnum*.

246 **(b)**
Chlamydomonas occurs in stagnant water (ponds and ditches), though some species are marine.

247 **(c)**
A mycorrhiza is a symbiotic association of a fungus with a roots system. The fungus provides minerals and water to the roots, in turn the roots provide sugar and N-containing compounds to the mycorrhizae. Some plants have the obligate association with mycorrhizae. For example, *Pinus* seeds cannot germinate and establish without the presence of mycorrhizae.

248 **(c)**
The members of class-Chlorophyceae are unicellular, colonial or filamentous have definite chloroplast commonly known as green algae. They are green due to the presence of chlorophyll-*a* and *b* pigments localised in chloroplast

249 **(b)**
In *Pinus*, the pollen grains at maturity are protected by three layered wall, outer most exine the secondexo-intine forms two balloon like outgrowths called **wings** and third is intine. Wings help in transportation of pollen grain from one place to another place.

250 **(d)**
The rhizoids in *Funaria* arise from the **basal region** of the stem, which functions as roots.

251 **(c)**
Endosperm in angiosperms develops as a fusion product of secondary nucleus with male gamete. Secondary nucleus is diploid chalazal polar nucleus and haploid microphylar polar nucleus

252 **(d)**
The bryophytes represent two morphologically distinct generations, *i.e.*, gametophytic and sporophytic. The gametophytic phase is dependent upon as well as being permanenty attached to the gametophyte, *e.g.*, *Riccia*, *Marchantia*.

253 **(a)**
Out of these, *Equisetum* is a vascular cryptogam.

254 **(c)**
Both statements are true

255 **(d)**
The giant red wood tree is a gymnosperm. The gaint *Sequoia* is the world's most massive tree and arguable the largest living organism on earth

256 **(d)**
In bryophytes, zygote is the beginning of the sporophytic generation. Within venter of the archegonium, the zygote undergoes segmentation and develops without a resting period into a multicellular, undifferentiated structure called embryo. The embryo by further segmentation and differentiation finally develops into a full fledged sporophyte, called sporogonium.

257 **(d)**
All the statements are correct.
Sexual reproduction occurs by the formation of sex organs born on special branches.
The male antheridia are produced on antheridiophore and the female reproductive organs are 'archegonia'. They are borne on special stalked structures called archegoniophore. Both male and female sex organ may be present on same thalli or different thalli.
After fertilisation, the egg becomes zygote, which grow to form sporophyte. It is differentiated into foot, seta and capsule. Inside the capsule, the diploid spore mother cells divide by meiosis and produce haploid spores. These spores germinate to form free-living gametophytes

258 **(a)**
Elaters are hygroscopic and help in dispersal of spores.

259 **(a)**
On the basis of involvement of cells, sporangium development is of two types :

Leptosporangiate (only one cell takes part)

Eusporangiate (a group of cells takes part).

260 **(c)**
In ferns, sporangium consists of stalk and capsule, later is filled with sporocytes, which undergo meiosis to produce haploid spores. The one layered wall of the capsule is thin and has a strip of cells called annulus. The cells of annulus have thickenings on the inner and radial walls but in some regions, its cells are thin walled. These regions are called stomium. Both annulus and stomium help in spore dispersion.

261 **(a)**
The characteristic red colour of algae is due to presence of excess amount of *r*-phycoerythrin, which masks the colour of other pigments

262 **(a)**
*Chlorella*is a unicellular green alga belonging to the class-Chlorophyceae, order-Chlorococcales and family-Chlorellaceae. It contains very high percentage of proteins and fats and also contains most of the known vitamins.

263 **(b)**
Water blooms are formed by the growth of some microscopic or semi-microscopic algae such as *Anabaena*, *Arthrospira*, *Nodularia*, *Nostoc*, etc. water blooms may be harmful because they are indirectly responsible for fish mortality due to depletion of oxygen.

264 **(a)**
Evolutionary relationship of organism

265 **(c)**
*Dryopteris*has circinate vernation of leaves but is homosporous.

Circinatevernation and heterospory is found in *Cycas*.

266 **(a)**
Endosperm in *Pinus* (gymnosperm) is formed before fertilization, *i*. *e*.,**haploid**.

267 **(c)**
Most of the members have one to many storage bodies called pyrenoids located in the chloroplast. Pyrenoids contain protein besides starch

268 **(a)**
True fertilisation together with triple fusion is known as double fertilisation, a unique phenomenon only occurs in angiosperms (absent in gymnosperms with few exception) and first time demonstrated by *Nawaschin* in *Fritillaria* and *Lilium*

269 **(b)**
Spirulina.
Spirulina (blue-green algae) is highly rich in proteins, vitamin-B complex and minerals. Powdered *Spirulina* is being used in herbal tonics and biscuits, *Chlorella* (50-55% proteins) and *Porphyra* (25-30% protein) are also used as a source of proteins

270 **(b)**
The spores of *Equisetum* when young are green and covered by a thin wall of cellulose. At maturity, they are relatively larger, rounded and contain numerous chloroplasts.

271 **(c)**
The leaves in pteridophytes are small (microphylls) as in *Selaginella* or large (macrophylls) as in fern

272 **(b)**
A- Biflagellate antherozoids, B-One egg

273 **(a)**
Heterosporous pteridophytes like *Selaginella* and *Marsilea* always produce dioecious gametophyte because microspore will form male gametophyte and megaspore will form female gametophyte

274 **(a)**
Volvox and *Fucus.*
Fusion of a large non-motile egg or ovum with a smaller motile sperm (except in Rhodophyceae). The gametes differ morphologically as well as physiologically and are called oogametes. The fusion of gametes is called oogamy, *e*. *g*., *Chlamydomonas*, *Fucus, Chara* and *Volvox*

275 **(a)**
Gametophyte refers to haploid plant that produces gametes. In **ferns,** haploid spore on germination gives rise to gametophyte, which is also called, **prothallus**. It bears both globose**antheridia** (male reproductive structure) and flask shaped **archegonia** (female reproductive structure).

276 **(a)**
Gametophyte and sporophytic phases are present in life cycle of bryophytes and both phases are morphologically distinct. The gametophytic phase is more conspicuous independent and dominant while sporophyte depends on gametophyte.

277 **(a)**
The plant body of bryophytes is more differentiated than that of algae
Difference between bryophytes and algae
(i) In bryophytes, tissue differentiation is well-developed, while in algae it is found only in higher forms
(ii) In algae, isogamous, anisogamous and oogamous type of sexual reproduction occur, while in bryophytes only, oogamous type of sexual reproduction is present
(iii) In bryophytes, sex organs are covered by a sterile jacket, while it is not covered in algae
(iv) Female sex organ in bryophytes is archegonium, while it is oogonium in algae
(v) In bryophytes sporophyte is dependent upon gametophyte, whereas in algae sporophyte is independent of gametophyte
(vi) Embryo is found in bryophytes, while it remains absent in algae
(vii) Sporophyte in bryophytes is differentiated into foot, seta and capsule

278 **(b)**
Microsporangia.
In gymnosperm, microspores develop into a male gametophytic generation, which is highly reduced and is confined to only a limited number of cell. This reduced gametophyte is called a pollen grain. Its development takes place in microsporangia

279 **(b)**
A-Zygote; B-Syngamy
In angiospermic sexual reproduction, syngamy is the nuclear fusion of the one male gamete with the egg producing diploid zygote or oospore

280 **(b)**
Numerical taxonomy which is now easily carried out using computers is based on all observable characteristics. Number and codes are assigned to all the characters and the data is then processed. In this way each character is given equal importance and at the same time hundreds of characters can be considered

281 **(a)**
Haplontic life cycle is primitive type of life cycle. Haplontic life cycle is followed by algae such as *Spirogyra, Volvox* and *Chlamydomonas*

282 **(c)**
In mosses the first stage is protonema stage, which develops directly from a spore

283 **(d)**
A fern (pteridophyte) differs from a moss (bryophyte) in the presence of independent sporophyte, while in moss the sporophyte is simpler than the gametophyte and remains attached to the parent gametophyte throughout its life. This sporophyte is dependent upon gametophyte partially or wholly for its nutrition.

284 **(a)**
Cell of sporophyte undergo meiosis of produce haploid cells called spores. As these spores are haploid in nature. It means each spore further divide to develop into the multicellular haploid generation of a plant. Thus, the number of chromosomes in leaf as well as in the spore will be same, *i.e.,* $n = 20$ ans

285 **(b)**
Pteridophytes are vascular cryptogams, bryophytes are non-vascular cryptogams. Pteridophytes are most primitive vascular plants and are also known as vascular cryptogams

286 **(b)**
*Cycas*stem shows large amount of parenchyma with secondary xylem tracheids. This type of wood is soft wood/manoxylic wood.

287 **(d)**
Pteridophytes constitute a group of cryptogams having well developed vascular tissue. These plants lack seed (although seed habit is seen in *Selaginella*).

288 **(c)**
In brown algae food is stored as complex carbohydrates, which may be in the form of laminarin or mannitol

289 **(d)**
The haploid unicellular spore of fern on germination forms prothallus, which possesses haploid, brown, hairlike delicate unicellular outgrowths. These are called rhizoids.

290 **(b)**
Gymnosperms lack ovary thus, fruits are absent. They possess naked seeds due to presence of naked ovules

291 **(d)**
All the statements are correct.
In mosses vegetative reproduction occurs through fragmentation or through bud in secondary protonema

292 **(b)**
Alginic acid or alginate is found in the middle lamella and primary cell walls of sea weeds such as, *Laminaria*, *Macrocystis*, *Ascophyllum*, etc.

293 **(a)**
Chlorophyll $-b$ is absent in brown algae. The colour of brown algae varies from olive green through light pigment fucoxanthin ($C_{40}H_{54}O_6$) in their chromatophores. This contain in addition to chlorophyll $-a$, chlorophyll $-c$, carotene and xanthophylls.

294 **(c)**
Bryophytes are autotrophic, non-vascular, spore forming, gametophytic plant body lacking seed habit.

295 **(a)**
*Ginkgo biloba*is a gymnospermic plant. It is also known as living fossil because it has a great fossil history.

296 **(a)**
*Acetabularia*is a single celled marine green alga.

297 **(d)**
Bryophyta includes simplest and primitive land plants characterized by presence of independent gametophyte and parasitic sporophyte.

298 **(c)**
Sclerenchyma cells are thick walled, lignified and dead at maturity. These provide mechanical support to the *Pinus* needle. Sclerenchyma may be fibrous or sclereid.

299 **(a)**
A-*Ectocarpus,* B- *Polysiphonia*, C-kelps

300 **(d)**
Agar-agar is obtained from *Gelidium* and *Gracilaria*. Agar-agar is used in solidifying laboratory culture media and is added as stabiliser or thickener in the preparation of jellies, puddings, creams, cheese, bakery, etc.

301 **(c)**
In gymnosperms megaspores develops into multicellular structure called multicellular female gametophyte that bears two or more archegonia or female sex organs

302 **(b)**
If the leaf of *Funaria* has 5 chromosomes, the primary protonema will have 5 chromosomes

303 **(b)**
Pollen grain.
In gymnosperm, microspores develop into a male gametophytic generation, which is highly reduced and is confined to only a limited number of cell. This reduced gametophyte is called a pollen grain. Its development takes place in microsporangia

304 **(c)**
Angiosperms.
The double fertilisation was discovered by SG Nawaschin (1898) and Guignard in *Lilium* and *Fritilaria*. Double fertilisation is restricted only to angiosperms. When pollen tube enters ovule, it strikes one of the synergids and burst open to release the two male gametes, which fuse with two different structures in the same female gametophyte. Thus, double fertilisation can be distinguished as
(i) **Generative Fertilisation** Fusion of one male gamete with the egg producing diploid zygote or oospore
(ii) **Vegetative Fertilisation** Fusion of nucleus of second male gamete with the diploid secondary (fused) nucleus or the triple fusion, i.e., fusion of one male nucleus and two polar nuclei forming endosperm ($3n$)

305 **(c)**
Algae produce different type of spores, the most common being the zoospores, asexually. These are motile, flagellated and give rise to new plant on germination

306 **(c)**
In green algae vegetative reproduction takes place by cell division, fragmentation, stolons tubers and different types of spores

307 **(c)**
In class-Rhodophyceae the photosynthetic pigments located in the chromatophores are chlorophyll-*a, d*, α-β-carotene, xanthophylls and biliprotein (*r*-phycoerythrin) (red in colour) and *r*-phycocyanin (blue in colour)

308 **(a)**
In mosses, the sporophyte developing from the embryo is a simple structure without rhizoids and is differentiated into foot, seta and capsule. **It is parasitic** (partially or wholly) **on the gametophyte**

as it is organically attached and is nutritionally dependent upon the gametophyte.

309 **(c)**
Gymnosperms are characterised by presence of naked ovules, which develop into seeds. The ovular integuments form the seed coat.

310 **(a)**
Haplontic life cycle is followed by algae such as *Spirogyra*

311 **(d)**
Salvinia,family-Salviniaceae is heterosporous fern, producing spores of different sizes.

312 **(c)**
Schizogenous(*Schizein*, to split) cavities are formed by the splitting up of common walls and the separation of masses of cells from one another. Inter-cellular spaces and these cavities form an inter-communicating system so, that gases and liquids can easily diffuse from one part of the plant body of the other. Most **resin-ducts** in plants especially **gymnosperms**, oil ducts (sunflower) are schizogenous cavities.

313 **(b)**
The fusion of male and female gametes is called fertilisation

314 **(c)**
Division/phylum A-angiospermae is sometimes called division-Anthophyta (anthe-flower; *phyto*-plant) because the common name for this group is the 'flowering plants'

315 **(c)**
The rhizoids in *Funaria* arise from the basal region of the stem, which functions as roots. These are multicellular and branched. The gemmae are multicellular, green and biconvex lens shaped bodies produced in gemma cup. *Sphagnum* is used as a packing material in the transportation of flower, live plants, tubers, bulbs seedlings, etc. It is also used in seed-beds and in moss-sticks. Mosses colonise on barren rocks along with lichens decompose rocks

316 **(b)**
In brown algae asexual reproduction takes place by the formation of motile zoospores and non-motile neutral spores. The zoospores are usually produced inside the zoosporangia. They are pyriform, biflagellate and have chromatophores, contractile vacuoles and eye spot. They have heterokont flagellations, *i.e.,* possess two unequal flagella, one whiplash type and the other tinsel-shaped

317 **(b)**
Sporophyte of fern produces spores. The spores germinate to produce haploid gametophyte, called prothallus. The prothallus bear antheridia and archegonia on their undersides

318 **(a)**
In pteridophytes, spore is a haploid structure, which develops after meiosis in the spore mother cell. On germination, it gives rise to a green haploid prothallus (gametophyte) which is monoecious, *i*. *e*., has both antheridia (male sex organs) and archegonia (female sex organs).

319 **(d)**
Diploxylic vascular bundle is found in rachis and leaflet of *Cycas*, *ie*, centripetal and centrifugal xylem are present at same time.

320 **(a)**
Alga is defined as an organism with chlorophyll $-a$ and thallus like body. These are haploid gametophytic, eukaryotic, chlorophyllous, non-vascular organisms.

321 **(d)**
*Sphagnum*and other mosses are the chief constituent of peat, that is why *Sphagnum* is called **peat moss.**

322 **(a)**
The main plant body in pteridophytes is sporophyte ($2n$) which is differentiated into root ($2n$), stem and leaf

323 **(d)**
All statements are correct

324 **(c)**
Both bryophytes and pteridophytes require water for fertilization.

325 **(d)**
Ferns exhibit alternation of dominant sporophyte generation with an inconpicuous gametophyte generation (heteromorphic)

327 **(c)**
Bryophytes are non-vascular thalloid, spore forming plants. Their main plant body is gametophytic, which is an independent, autotrophic, haploid gametes bearing phage of

bryophytes.

328 **(b)**
In gymnosperm pollen grain is released from microsporangium and carried with the help of air current. It comes in contact with opening of ovule

329 **(b)**
A-Antheridial branch; B-Archegonial branch

330 **(a)**
Myxophyceae (cyanobacteria, blue-green algae) have incipient nucleus, in which nuclear envelope is absent.

332 **(d)**
Sporophyte - Diploid ($2n$)
Antheridia – Haploid (n)
Rhizoids - Haploid (n)

333 **(d)**
Hypnospores are the means of asexual reproduction in *Chlamydomonas*. Sometimes, the protoplasts of palmella develop a thick wall to form the hypnospores. They may develop a red-coloured pigment haematochrome in *Cinivalis* and thus, causing the phenomenon of red snow. On the arrival of favourable conditions, they develop into zoospores.

334 **(d)**
The gaint brown algae are called kelps. The largest kelps are *Nereocystis* (20-30 m) and *Macrocystis* (40-50 m). Brown algae have gelatinous coating outside the, cellulosic cell wall called algin. Alginic acid is extracted commercially from gaint brown algae or kelps. Many brown algae are used as food in some countries. Food obtained from *Laminaria saccharina* is known as 'kombu'. It is rich in carbohydrates

335 **(b)**
Double fertilisation is characteristic feature of angiosperms. It does not take place in algae, bryophytes, pteridophyte and most gymnosperms. True fertilisation together with triple fusion is known as double fertilisation

336 **(b)**
A-Strobilus, B-Node, C-Branch

337 **(c)**
In angiosperms, flower bears male and female sex organs. Male sex organ is stamen also known as androecium. It consist of an anther lobe and a filament. Anther produces pollen grains. Female sex organ is carpel also known as pistil/gynoecium. It consists of three parts style, stigma and ovary

338 **(a)**
After fertilisation the ovaries develop into fruit

339 **(d)**
*Porphyra*is used as food in various countries and *Rhodymania palmata* is chewed as tobacco in Scotland.

340 **(b)**
In *Ulothrix*, meiosis occurs in zygospore.

341 **(d)**
Juvenile stage of moss is protonema, which develops directly from a spore. It is a creeping, green, slender, branched and frequently filamentous stage

342 **(b)**
Fruits are mature ovaries. The ovules develop into the seeds, the integuments become the seed coat and the ovary becomes the fruit

343 **(d)**
Megasporophyll of *Cycas* bears ovules, hence, it is equivalent to **carpels** of angiosperms.

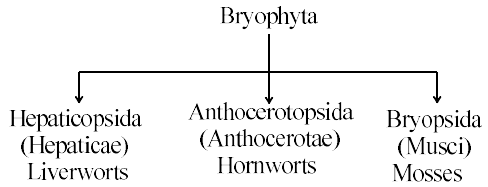
344 **(d)**
Bryophytes shows considerable economic importance. They colonise on barren rocks along with lichens and decomposed rocks. When they grow on rocks, the help in soil formation. Some bryophytes also work as soil binders when they grow in aggregations

345 **(b)**
Each microsporophyll has two microsporangia on the **abaxial** surface. In microsporangium, are developed.

346 **(b)**
The plant body of bryophytes are multicellular, thallus like, prostate or erect, many celled thick and fixed to soil by unicellular or multicellular rhizods. These rhizoids are without vascular tissue and cytoplasm

347 **(b)**
In some pteridophytes, two types of spores are formed which differ significantly in their size and also in function. This phenomenon is called heterospory, *e. g.*, *Selaginella* and *Marsilea*, etc.

348 **(a)**
Bryophytes including liverworts, hornworts and mosses shown alteration of generations



349 **(b)**
About 90% of the total green algae grow in freshwater environment. The algae is divided into three main classes *i.e.*, Chlorophyceae, Phaeophyceae and Rhodophyceae

350 **(c)**
Mosses are the bryophytes with gametophytic plant body, $e.g.$, *Funaria*. On the lower portion of leafy gametophore of moss, numerous branched multicellular rhizoids with oblique septa are present. These rhizoids are meant for the purpose of attachment or anchorage to the substratum.

351 **(c)**
In *Vaucheria*, the reserve food material is oil (instead of starch) occurring as small colourless droplets in the cytoplasm. However, filaments growing in continuous light may accumulate food in the form of starch.

352 **(a)**
Coralloid roots have an algal zone in middle cortex. Some nitrogen fixing blue-green algae like *Anabaena*, *Nostoc*, *Cycadacearum*are found in algal zone.

353 **(c)**
In *Cycas* the 3-celled microspores are shed in the air after the dehiscence of the sporangium. They are very light in weight and are carried by air current (anemophily).

354 **(a)**
Spore is the first cell of gametophytic generation in *Funaria*. On approach of favourable conditions, the spore absorbs water. Now, the exine ruptures and intine comes out in form of germ tube. It divides and enlarges to form a branched alga-like filamentous **protonema**.

355 **(b)**
Inorganic phosphorus and nitrogen are responsible for the growth of algae. In polluted water, amount of these inorganic substances increases due to which algae increases greatly at the surface of water or pond. Extensive increase of these algae is called water bloom. Due to death of these algae their organic matter gets decomposed. This leads to oxygen depletion due to which aquatic animals die. If these activities persist for long time, the pond has more organic matter and less water. This process is called eutrophication.

356 **(b)**
A-*Volvox*, B-*Chlamydomonas*, C-*Chara*

357 **(a)**
In ferns, the embryo is a diploid structure as it is formed by the fusion of gametes, while the spores are haploid structures formed by meiosis in diploid spore mother cell. Thus, if number of chromosome in embryo is 8 $(2n)$, then the number of chromosomes in spores shall be $4(n)$.

358 **(d)**
Gelidium, *Graccilaria* and *Pterocladia*are red algae having industrial importance. They produce a jelly like substance agar-agar which used as culture medium with a number of different uses.

359 **(a)**
Chlorella,a green alga is used as food because it is rich in **proteins** (50%), **carbohydrates** (20%), **fats** (20%), **vitamins** and **minerals** (10%). It provides an antibiotic **chlorellin**.

360 **(d)**
An ideal embryo sac contains 7-cells and 8-nuclei. Embryo sac consists one egg cell, two synergids, three antipodal cells and two polar nuclei in a central cell

361 **(c)**
Female reproductive organ of bryophytes is archegonium. Oogonium is a female reproductive organ of some algae and fungi. Sporangium is a sac like structure, which produces asexual spores in cryptogams and phanerogams.

362 **(b)**
70 species of marine algae like *Porphyra, Laminaria* and *Sargassum* are used as food

363 **(a)**
*Chlamydomonas nivalis*grows in polar regions imparting red colour to snow, hence the name red snow.

364 **(b)**
The thallus of *Volvox* is hollow ball like flagellate

colony. It is called as **coenobium.**

365 **(a)**
The peristome of moss consists of two sets of long conical teeth. There are 16 teeth in each set, the total being 32.

366 **(a)**
Land plants all have heteromorphic alternation of generations, in which the sporophyte and gametophyte are distinctly different

367 **(c)**
*Ginkgo*a gymnosperm is also known by alternative name called 'maiden hair tree'.

368 **(d)**
Girdle-shaped chloroplast is present is *Ulothrix*.

369 **(c)**
A − *Dictyota*B − *Polysiphonia*

C − *Porphyra*D − *Laminaria*

E − *Fucus*

370 **(b)**
Chlorophyll-*a*, xanthophylls and carotenoids.
Gk; *Phaios* = brown, *Phyton* = plants
Phaeophyceae cell contains more than one parietal chromatophores. The chromatophores contain chlorophyll-*a* and c β-and α-carotenes and xanthophylls. Besides, they contain large amount of brown coloured xanthophyll-fucoxanthin, which masks the green colour of chlorophylls and that is why these algae appear brown in colour

371 **(d)**
In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result, self-fertilization is prevented.

372 **(d)**
In flowering plants, a cross section of the developing anther displays four chambers. These chambers are called pollen sacs. Each pollen sac is filled with cells containing large nuclei. As the anther grows each of these cells goes through two meiotic divisions, forming a tetrad. These cells are called microspores. Each one of these microspores eventually becomes a pollen grain and in carpel meiosis takes place at the time of megaspore from megaspore mother cell

373 **(c)**
Spirulina (blue-green algae) is highly rich in proteins, vitamin-B complex and minerals. Powdered *Spirulina* is being used in herbal tonics and biscuits, *Chlorella* (50-55% protein content) and *Porphyra* (25-30% proteins) are also used as a source of proteins.

374 **(a)**
Rhodophyceae - floridean starch

Phaeophyceae - laminarian, mannitol

Chlorophyceae - starch

375 **(c)**
Chlamydomonas shows isogamy and anisogamy types of sexual reproduction

376 **(d)**
Mosses are green, leafy upright and radial in symmetry. They are highly developed of all the bryophytes

377 **(a)**
Cyanobacteria or blue-green algae are autotrophic organisms, which belong to the class-Cyanophyceae. These possess chromatophores instead of chloroplasts (membrane bound structures containing photosynthetic pigments and the site of photosynthesis).

378 **(d)**
The leaves in case of gymnosperms are well adapted to with stand extremes of temperature, humidity and wind. These shapes are xeromorphic adaptations because they reduce the amount of surface area available for evaporation. They have many other xeromorphic adaptation, which include a thick cuticle, sclerified epidermal cells, sunken stomata, a sclerotic hypodermis, tightly packed mesophyll, an endodermis, few or no lateral veins and centrally located vascular tissue

379 **(a)**
*Cycas*reproduces vegetatively by forming **bulbils** or adventitious buds, which differentiated on the main stem. The base of bulbil is swollen and covered by the scale leaves, at its tip a few foliage leaves arise, after detachment they give rise to a new plant.

380 **(b)**
Cytotaxonomy is based on cytological studies of the cell including the size, structure and number of chromosomes as well as behavior of

chromosomes during meiosis for classification purposes

381 **(d)**
All the statements are correct
The life cycle of bryophytes consists of two distinct phases
(i) The gametophytic phases
(ii) The sporophytic phase
The haploid gametophyte is dominant, long lived, green and independent, whereas the diploid sporophyte is short lived and dependent upon the gametophyte some cells of the sporophyte under go meiosis to produce haploid spores. These spores germinate the produce gametophyte

382 **(a)**
In mosses vegetative reproduction occurs through fragmentation or through bud in secondary protonema

383 **(c)**
Polygonum type of embryo sac is the most common in angiosperms. It is 7-celled and 8-nucleate. The nuclei are arranged in such a way that three organised at micropylar end and form egg apparatus (one egg and two synergides,) two nuclei migrate to centre and form polar nuclei in a single central cell and three nuclei at chalazal pole organised into antipodal cells

384 **(a)**
The given features are of *Cycas*.

385 **(b)**
Heterospory is the production of spores of two different sizes and of two different developmental patterns. Heterospory is an expression of sex determining spores of the plant. It is the most important evolutionary development in the vascular plants because it has ultimately lead of seed development, *e*. *g*., *Selaginella*, *Salvinia, Azolla*, etc.

386 **(b)**
Carolus Linnaeus a Swedish botanist, who published an artificial system of classification based exclusively on floral characters

387 **(c)**
Fragmentation.
Algae reproduce by vegetative, asexual and sexual methods. The vegetative and asexual methods are abundant. Algae reproduce vegetatively by fragmentation and asexually by means of motile or non-motile spores. Sexual reproduction occurs through fusion of two gametes

388 **(d)**
True roots, stem and leaves having vascular supply absent but root like, non-vascular rhizoids, leaf like and stem like structures are present

389 **(d)**
Blue-green algae show prokaryotic cell organization, which is characterized by the presence of DNA without histones (but some basic proteins present) 70 S ribosomes, absence of nuclear membrane and membrane bound organelles. Many species like *Nostoc*, *Anabaena* contain heterocyst, which is specialized for nitrogen fixation.

390 **(b)**
S R Kashyap is known as **father of Indian Bryology** for his contribution.

391 **(c)**
The chloroplast of *Anthoceros* contains 'pyrenoid', made up of 25-30 discoid or spindle-shaped bodies.

392 **(d)**
*Cycas*resembles with angiosperm, due to presence of siphonogamy, *i*. *e*., male gametes are carried to the female gametes through pollen tube.

393 **(a)**
Megasporophyll is the term used in gymnosperm to denote carpel (female reproductive organ). The megasporophylls are loosely arranged in *Cycas*. They do not form a true female cone. Female reproductive structure is a rosette of megasporophylls arising spirally in acropetal succession on the stem apex of female plant. In *Pinus* each megasporophyll consists of a lower bract scale and a larger upper ovuliferous scale

394 **(a)**
Haplo-diplontic life cycle is followed by bryophytes and pteridophytes. In this case sporophytic as well as gametophytic phases is multicellular

395 **(d)**
Green alga contains chlorophyll $-a$ and b as well as small amount of carotenoid pigments are located in the grana of chloroplast, as it occurs in the land plants. Reserve food material is stored in the form of starch.

396 **(b)**

In the ectophloicsiphonostele, the xylem surrounds pith and this xylem is surrounded by phloem, pericycle and endoderm respectively, *e. g.*, *Osmunda* and *Equisetum*.

397 **(a)**
A- *Mycorrhiza*, B- *Pinus.*
Mycocorrhizal associations are mutualistic association between higher fungi and gymnosperms (*Pinus*) or angiosperms in the plant

398 **(a)**
Sphagnum is a bryophyte, commonly called as bogmass or peat moss. It is hygroscopic and possesses a rem arkable water holding capacity. Hence, it is used as a packing material in the transportation of flowers, live plants, tubers, bulbs, seedlings, etc. It is also used in seed-beds and in moss-sticks

399 **(d)**
Bryophyte is a group of embryo producing plants, which do not bear fruits, seeds and any vascular tissue. They are known as 'amphibians of plant kingdom'. Body is thalloid and green (due to presence of chloroplast). Male sexual organ is antheridium and female sexual organ is archegonium.

400 **(a)**
In *Spirogyra*, lateral conjugation occurs in homothallic filament.

401 **(b)**
The protonema is a stage in the life cycle of *Funaria*. Protonema is the juvenile stage of moss. It results from the germinating meiospore

402 **(d)**
Dinoflagellates like
Noctiluca, *Gonyaulax*, *Pyrocystis* show bioluminescence.

403 **(b)**
The haploid gametophyte is dominant, long lived, green and independent whereas the diploid sporophyte is short lived and dependent upon the gametophyte

404 **(d)**
Flagellated male gametes are present in *Riccia*, *Dryopteris* and *Cycas*.

405 **(b)**
Brown algae are vary in colour from olive green to various shades of brown depending upon the amount of the xanthophyll pigment, fucoxanthin present in them

406 **(b)**
Nostoc is a blue-green alga or cyanobacterium. It is filamentous and in most cases colonial blue-green alga. It occurs in free state as well as in symbiotic association with Anthoceros (a bryophyte) or with Gunnera manicata (an angiospermic marsh plant).

407 **(c)**
The members of class-Chlorophyceae usually have a two layered rigid cell wall made up of cellulose and pectose. Inner layer of cell wall is made up of cellulose, while outer layer is made up of pectose

408 **(a)**
Zygotic meiosis takes place in algae (*Chlamydomonas*, *Oedogonium*, *Spirogyra*, etc) and fungi (*Rhizopus*, *Mucor*, etc.)

409 **(b)**
Fertilization in *Cycas* is siphonogamous followed by zooidogamous. During fertilization the pollen tube discharging its contents into the liquid of archegonial chamber. The cilia and membrane of sperm slips off and cytoplasm and nucleus fuses with the egg forming oospore.

410 **(a)**
The zygote of *Pinus* immediately germinates. It undergoes a series of mitotic divisions, still enclosed within the ovule to form a relatively elaborated 16 celled proembryo. The four lowermost cells farthest from the micropylar end constitute the **embryonaltier, suspensor tier** the third tier from below is called the **rosette tier**.

411 **(b)**
The kingdom-Plantae includes algae, bryophytes pteridophytes, gymnosperms and flowering plants (angiosperms). They are common on land, on sea shore and in freshwater

412 **(b)**
Haploid spore is the first cell of gametophytic generation. The spores of moss germinate to form protonema. The cells of protonema contain chloroplasts.

413 **(a)**
Pteridophytes mostly occur in cool, damp and

shady places. Pteridophytes are fundamentally terrestrial plants but they are dependent on an external source of water for completion of their life

414 **(b)**
Protonema is a branched, multicellular, filamentous or (less commonly) thalloid structure, produced on germination of a bryophyte spore, from which new plant develops as buds.

It forms the juvenile filamentous stage in the life cycle of *Funaria*.

415 **(a)**
Some bryophytes also work as soil binders, when they grow in aggregations

416 **(b)**
Heterospory is the production of spores of two different sizes and of two different developmental patterns. Heterospory is an expression of sex determining spores of the plant. It is the most important evolutionary development in the vascular plants because it has ultimately lead to seed development,
e. g., *Selaginella*, *Salvinia*, *Azolla*, etc.

417 **(a)**
In moss capsule, shock absorbers are **trabeculae.**

418 **(b)**
Protonema is slender, green, branched and filamentous gametophytic phase in the life cycle of *Funaria*.

419 **(c)**
The plant life cycle has both a sporophyte and a gametophyte generation. The stage of a plant life cycle, that produces spores by meiosis and alternate with the gametophyte stage is called sporophytic stage

420 **(b)**
Hutchinson system of classification

421 **(d)**
Transfusion tissue is present in the leaves of *Cycas* and *Pinus*, made up of horizontally arranged tracheidal cells and is meant for lateral conduction of water and minerals to mesophyll tissue upto margins.

422 **(d)**
The life cycle of bryophytes consists of two distinct phases
(i) The gametophytic phase
(ii) The sporophytic phase
The haploid gametophyte is dominant, long lived green and independent, whereas the diploid sporophyte is short lived and dependent upon the gametophyte

423 **(c)**
Pyrenoids are proteinaceous bodies present in chromatophores. These are considered to be associated with synthesis and storage of starch. In members of Chlorophyceaepyrenoids are surrounded by starch plates.

424 **(b)**
Antherozoids of ferns and mosses are stimulated by special chemicals, this movement is known as **chemotaxis.**

425 **(b)**
Algae plays an important role in carbon dioxide fixation on earth through photosynthesis and increase the level of O_2

426 **(c)**
Asexual reproduction is by flagellated zoospores produced in zoosporangia. The sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous or oogamous. In isogamy, gametes are morphologically and physiologically different but physiologically same and in oogamy, gametes are both morphologically and physiologically different, *e. g.*, *Ulothrix* and *Spirogyra* members of Chlorophyceae

427 **(b)**
In class-Phaeophyceae the accumulation product of photosynthesis is D-mannitol or laminarin

428 **(b)**
Apophysis is the apical sterile portion of the microsporophyll in *Cycas*.

Apospory is the formation of gametophyte directly from sporophyte.

Apogamy is the formation of sporophyte directly from gametophyte.

429 **(a)**
The first division, which comes under kingdom-Plantae is algae

430 **(d)**
Microsporangia are produced at the extreme tip

of microsporophyll. Microsporangia is a sporangium that produces spores that give rise to male gametophyte

431 **(a)**
The filamentous stage produced from the developing spores of the mosses is called **protonema.** It gives rise to the gametophore.

432 **(c)**
Fusion of morphologically dissimilar gametes, which may be motile or non-motile. The female gamete is usually larger and non-motile and male gamete is smaller. They fusion of large and small gametes is called anisogamy
e. g., *Chlamydomonas*

433 **(b)**
Heterosporouspteridophytees like *Selaginella* and *Marsilea* always produce **dioecious gametophyte** because microspore will form male gametophyte and megaspore will form female gametophyte.

434 **(b)**
Spirulina (a blue-green alga) is a rich source of protein, many vitamins especially B-complex and minerals. It has a promising supplementary value to the common Indian cereals such as rice, wheat and ragi. Hence, doctors are advised the patients to take *Spirulina* in their diet for recovery.

435 **(c)**
A ring of multiciliatezoogonidium is found in the algae *Oedogonium*.

436 **(a)**
Sterile part of *Cycas* microsporophyll is **apophysis**.

437 **(d)**
When a group of plants is represented by a single genus or species, while rest of the other representatives of the group have become extinct and fossilized, the long surviving individual is called a living fossil, *eg*, *Ginkgo biloba*. However, *Cycas* is also regarded as a living fossil because most of the cycad species are confined to tropical and subtropical regions and the group is becoming endangered.

438 **(d)**
Pollen grain is released from microsporangium and carried with the help of air current. It comes in contact with opening of ovules. Male gamete fuses with egg to give rise zygote. Zygote develops into embryo and embryo into seeds. In angiosperm archegonium is absent

439 **(b)**
*Funaria*is a pleurocarpous moss, *i. e.*, have male reproductive structures on main axis and female reproductive structures on lateral branches.

440 **(d)**
In the members of Phaeophyceae or brown algae, food is stored as complex carbohydrate, which may be in the form of laminarian or D-mannitol.

The members of Rhodophyceae are commonly called red algae because of the predominance of the red pigment, r −phycoerythrin in their body.

441 **(a)**
Like plants, algae have cell walls which contain either polysaccharides such as cellulose (glucan) or a variety of glycoproteins or both. The inclusion of additional polysaccharides in algal cell walls is used as a feature for algal taxonomy. Mannans form microfibrils in the cell walls of a number of marine green algae including those from the genera *Codium*, *Acetabularia* as well as in the walls of some red algae like *Porphyra*.

442 **(a)**
Chloroplast.
Green algae store food in form of starch in specialised structures called pyrenoids located in chloroplast. Each pyrenoid has a central protein called 'pyrenocrystal' and a surrounding starch sheath

443 **(b)**
Indusium is found in ferns.

445 **(a)**
The predominant stage of the life cycle of a moss is the gametophyte, which consists of two stages. The first stage is protonema stage, which develops directly from a spore.
The second stage is the leafy stage which develops from the secondary protonema as a lateral bud. They consist of upright slender axe bearing spirally arranged leaves. They are attached to the soil through multicellular and branched rhizoids. This stage bears the sex organs

446 **(b)**
In both gymnosperms and angiosperms, the

megaspore mother cell undergoes meiosis and produces four haploid megaspore. Out of four megaspore three will degenerate. Therefore, for formation of 64 zygotes in gymnosperm and angiosperm 64 meiosis in megaspore mother cell will required. Whereas the microspore mother cell in both gymnosperm and angiosperm undergoes meiosis and produced four haploid microspore. All the four will be functional therefore, for formation of 64 zygotes, 16 meiotic division in microspore mother cell will be required.

447 **(a)**
In gymnosperm, microspores develop into a male gametophytic generation, which is highly reduced and is confined to only a limited number of cell. This reduced gametophyte is called a pollen grain. Its development takes place in microsporangia

448 **(c)**
A monoecious plant has both male and female reproductive organs on the same individual (plant) while dioecious plants are unisexual, having male and female reproductive organs on different individuals (plants).

449 **(b)**
Volvox, *Spirogyra* and *Chlamydomonas*are all green algae belonging to class-Chlorophyceae.

450 **(b)**
Megaspores are haploid

451 **(c)**
In the stem of *Cycas*, the stele is eustele type, which consists of a ring of discrete vascular bundles. In these bundles, the primary cambium lies between the phloem and xylem.

452 **(b)**
Heterotrichous habit having prostrate and erect system by a filamentous thallus is must for evolution of terrestrial plants. It is found in green algae like *Fritschiella*, other examples are *Draparnaldiopsis* and *Stigeocolonium*.

453 **(b)**
In bryophytes, the haploid gametophyte is dominant, long lived, green and independent whereas the diploid sporophyte is short lived and dependent upon the gametophyte. Water is essential for reproduction. The sex organs are multicellular and jacketed with sterile jacket

454 **(d)**
The gaint *Sequoia* is the world's most massive tree and arguable the largest living organism on earth

455 **(b)**
Fusion of morphologically dissimilar gametes, which may be motile or non-motile

456 **(d)**
The plant body of some highly advanced forms (*e*. *g*., Fucales, Laminariales) is differentiated into basal more or less root-like hold fast, erect branched or unbranched, tubular or compressed stipe and leaf-like blades the frond

457 **(b)**
In *Ulothrix*, the cells in the filament commonly produce and discharge the zoospores about the same time just after sunrise.

458 **(d)**
Indusium is a protective kidney-shaped covering of sorus present in *Dryopteris*.

459 **(a)**
Pollen grains in *Pinus* are **monosaccate**. In *Pinus*, pollen grain is unicellular, three layered: outer exine, the middle exo-intine and innermost intine.

460 **(a)**
The characteristic feature of fern's leaves is circinate venation in which coiled arrangement of leaves and leaflets is found in the bud.

461 **(b)**
Protonema is the juvenile stage of moss resulting from the germinating meiospore and consists of a slender, green, branching system of filaments. In *Funaria*, the protonema stage is only vegetative and transitory, which precedes the upright, leafy gametophyte.

462 **(c)**
Gamete is the haploid reproductive cell that fuses with another gamete to form a diploid zygote. These are not surrounded by the cell wall. On the other hand, root hair cell stem hair cell and bacterial cell, all possess a well defined cell wall.

463 **(b)**
Cycads possess top-shaped, multiciliate male gametes and he mature seed, which bears only one embryo with two cotyledons.

464 **(a)**

The **pteridophytes** exhibit alternation of dominant sporophytic generation with an inconspicuous gametophytic generation. The sporophyte is differentiated into root, stem and leaves, while the small and inconspicuous gametophyte is independent and autotrophic.

465 **(b)**
Pteridophytes are vascular cryptogams. They generally produce spores but do not produce seeds.

Bryophytes are non-vascular but spore forming cryptogams.

Gymnosperms and **angiosperms** are vascular and seed forming phanerogams. All seed forming plants are also known as **spermatophytes**.

466 **(c)**
c −phycocyanin pigment is found in blue-green algae (cyanobacteria).

467 **(c)**
Unicellular smooth and tuberculated rhizoids are present in the region of midrib at ventral surface of *Riccia*.

468 **(c)**
Fucus,a brown alga displays a diploid life history. The zygote ($2n$) becomes an embryo and develops into the mature *Fucus* with receptacles at the tip of the algae.

469 **(b)**
Gymnosperms are naked seeded plants because seeds are presents on the megasporophyll and are not enclosed with fruit wall due to lack of ovary wall

470 **(b)**
Pinus,is a gymnospermic plant that does not have *Rhizobium* containing root nodules.

471 **(d)**
A- Stigma, B-Anther, C-Male gametophyte, D-Egg, E-Ovule

472 **(d)**
In gymnosperms the plants are diploid and well adapted to extreme conditions, *e*. *g*., the leaves in case of gymnosperms are well adopted to withstand extremes of temperature, humidity and wind. These shapes are xeromorphic adaptations because they reduce the amount of surface area available for evaporation. They grow bearing sporophylls incompact structures called cones

473 **(c)**
After fertilisation ovules develop into seeds and ovaries develop into fruit

474 **(d)**
Most algal genera are haplontic, some of them such as *Ectocarpus, Polysiphonia*, *Kelps* are haplodiplontic. *Fucus*, on alga is diplontic

475 **(a)**
*Azolla*is an aquatic fen with bilobed leaves. It encloses large mucilage cavity, which contain filaments of *Anabaena azollae*. *Anabaena* fixes nitrogen from air into nitrogenous compounds, which accumulate in the air spaces in leaves and in return takes food material and shelter from plant.

476 **(c)**
*Nostoc*is an alga. It contains chlorophyll and can prepare its own food, *i*. *e*., autotrophic.

477 **(c)**
In some pteridophytes sporophylls may form distinct compact structure called cone or strobili. *e*. *g*., *Selaginella, Equisetum*

478 **(b)**
Brown algae show great variation in size and form. They range from simple branched, filamentous forms (*Ectocarpus*) to profusely branched forms as represented by kelps, which may reach a height of 100 metres. The giant brown algae are called kelps. The largest kelps are *Nereocystis* (20-30 m) and *Macrocystis* (40-60 m)

479 **(b)**
In *Chlamydomonas*, the meiosis occurs in zygote.

480 **(c)**
Sphagnum

481 **(c)**
Pteridophytes are spore forming, non-seed bearing, non-flowering vascular plants.

Thallophytes do not have vascular tissues.

Bryophytes also come under thallophytes.

Spermatophyte is a group of seed forming vascular plants. It includes gymnosperms and angiosperms.

482 **(d)**

The female cone of *Pinus* is formed by the aggregation of megasporophylls, which bear ovules. Each megasporophyll consists of a lower bract scale and a larger upper ovuliferous scale.

483 **(d)**
Algae include unicellular forms like *Chlamydomonas*, filamentous like *Ulothrix* and colonial forms like *Volvox*

484 **(d)**
Protonema is the juvenile stage of moss. It results from the germinating meiospore. When fully grown, it consists of a slender green, branching system of filaments called the protonema

486 **(d)**
*Volvox*is a freshwater green alga. It occurs in **colonies** or coenobium (in definite number or group), surrounded by a pellicle (gelatinous glycoprotein) layer. Each pyriform shaped cell has two long similar and **smooth flagella**, eye spot, cup-shaped chloroplast with pyrenoids and contractile vacuoles.

487 **(c)**
Hydropterids are only plant among the heterosporous. Pteridophytes that are leptosporangiate. Leptosporangiate in which the sporangium origin from epidermal cell Heterosporous pteridophytes were the first land flora of earth. The difference in size between microspore and megaspore is 1:2000 female gametophyte of *Selaginella* mostly have single archegonium

488 **(a)**
Male sex organ is stamen also known as androecium. It consists of an anther lobe and a filament. Anther produces pollen grains

489 **(d)**
*Cephaleuros*is a green parasitic alga, which causes red rust of tea and coffee.

490 **(c)**
*Fucus*belongs to class-Phaeophyceae, in which reserve food is found in form of laminarian, mannitol and oil.

491 **(a)**
Sporophyll → Strobili → Sporangia → Spore mother Cell → Spores

492 **(c)**
After fertilization, the ovary develops into fruit and ovary wall forms the fruit wall (pericarp). But gymnosperms have naked seeds because in gymnosperms, ovary (pericarp) is absent.

493 **(a)**
In ammensalism, one component (species) is harmed and the other remains unaffected. The alga *Microcysis* release hydroxyl amine that kills the surrounding fauna but the alga itself remain unaffected.

494 **(d)**
Bryophytes resemble algae in many ways, some of which are

(i) thalloid plant body

(ii) absence of roots

(iii) absence of complex vascular tissues

(iv) autotrophic mode of nutrition

(v) reserve food material is true starch.

495 **(d)**
Algae are chlorophyll-bearing, simple thalloid, autotrophic and largely aquatic organisms. They occur in a variety of other habitats: moist stones, soil and wood. Some of them also occur in association with fungi (lichen) and animals (*e*. *g*., on sloth bear)

496 **(a)**
The bryophytes are divided into liverworts and mosses

497 **(a)**
In red algae vegetative reproduction takes place by fragmentation. The reserve food material is in the form of floridean starch. It is very much similar to amylopectin and glycogen in structure. The cell wall is made up of cellulose, pectic compounds and certain mucopolysaccharides called phycocolloids

498 **(c)**
The stem of *Selaginella*, *Kraussiana* shows distelic condition. Some air spaces develop between the endodermal cells isolating two steles from the cortex. The endodermal cells elongate to form trabeculae connecting the two tissues. The stele remains suspended by thisunicelled (rarely multicelled) trabeculae.

499 **(a)**
The akinetes and aplanospores are asexual bodies

in *Spirogyra*. These are haploid structures. The zygospore is formed during sexual reproduction by fusion of two protoplasts. Prior to germination, the diploid zygospore nucleus undergoes meiosis.

500 **(a)**
The archegonialventer forms a protective covering around the embryo called **calyptra.**

501 **(a)**
Ectocarpus, Dictyota, Laminaria, Sargassum and *Fucus*, all are the examples of class-Phaeophyceae

502 **(b)**
In *Spirogyra*, the sexual reproduction involves the fusion of two morphologically identical isogametes, and physiologically dissimilar anisogametes. This is an advanced feature. In this, the active gamete is known as the male and the passive as the female.

503 **(b)**
Boxboumia aphylla is a classical example of saprophytic bryophyte

504 **(b)**
A-*Fucus*, B-*Polysiphonia*, C-*Porphyra*, D-*Dictyota*

506 **(d)**
The diploid bispiral elaters are hygroscopic. They help in the dispersal of spores in *Marchantia*.

507 **(d)**
Pteridophytes are called vascular cryptogams also known as seedless vascular plants. They produce spores rather than seeds

508 **(a)**
Fern gametophyte is homothallic. It bears male gamete (antherozoid) and the female gemete (egg, cell).

509 **(b)**
An androgynous receptacle is the one which contains antheridia on upper side and archegonia on lower side, *e. g.*, *Marchantia*.

510 **(d)**
Class-Rhodophyceae.
In class-Rhodophyceae the photosynthetic pigments located in the chromatophores are chlorophyll-*a, d*, α-β-carotene, xanthophylls and biliprotein (*r*-phycoerythrin) (red in colour) and *r*-phycocyanin (blue in colour)

511 **(c)**
In *Dryopteris*, the young parts of the leaves and rhizome while in *Cycas*, scaly leaves remain covered with small brown hair called ramenta.

512 **(a)**
The sperm of *Cycas* is top-shaped with numerous cilia arising from a spiral line running from the pointed end towards the broader end. The sperm of *Cycas* is perhaps the largest of all known male cell in plant and animal kingdom.

513 **(d)**
IN *Marchantia* a bryophyte, the archegonia (female sex organ) are borne on special branches called **archegoniophore** or female receptacles. Each archegoniophore has rows of archegonia protected by involucre or perichaetium.

514 **(c)**
In *Pinus*, each male cone consists of an elongated axis, bearing a number of spirally arranged **microsporophylls**. On the underside of which two microsporangia develop and get filled with microspores (pollen grains).

515 **(b)**
*Ginkgo*is a gymnospermic plant, so it comes before angiospermic plant, *Pisum* (pea).

516 **(b)**
Pteridophytes are spore forming non-seed bearing, non-flowering vascular plants. An anthimintic drug is obtained from the rhizomes and petioles of the fern.
Dryopteris, Lycopodium is used in treatment of rheumatism and disorders of lungs and kidneys. They are used as soil binders. Presence of heterospory (morphologicacally two levels of spores) is a characteristic features of pteridophytes

517 **(c)**
Corolloid root is developed in *Cycas*. It contain an algae zone in the cortex. This algal zone contains blue-green algae (cyanobacteria) like *Nostoc*, *Anabaena*, which grow in symbiotic association with corolloid root

518 **(c)**
Leaf in young condition in fern is called circinateptyxis(*i. e.*, coiled like a spring).

1)	a	2)	a	3)	d	4)	b	193)	a	194)	c	195)	a	196)	c
5)	b	6)	a	7)	c	8)	a	197)	d	198)	a	199)	b	200)	a
9)	b	10)	a	11)	a	12)	b	201)	b	202)	b	203)	d	204)	b
13)	b	14)	b	15)	a	16)	d	205)	b	206)	a	207)	c	208)	b
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25)	d	26)	a	27)	d	28)	b	217)	c	218)	d	219)	a	220)	c
29)	b	30)	b	31)	a	32)	d	221)	a	222)	c	223)	d	224)	a
33)	b	34)	b	35)	d	36)	b	225)	d	226)	b	227)	c	228)	d
37)	d	38)	a	39)	b	40)	a	229)	b	230)	c	231)	c	232)	d
41)	d	42)	c	43)	b	44)	d	233)	a	234)	c	235)	a	236)	b
45)	d	46)	a	47)	c	48)	c	237)	d	238)	b	239)	c	240)	a
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61)	b	62)	c	63)	b	64)	d	253)	a	254)	c	255)	d	256)	d
65)	c	66)	d	67)	b	68)	b	257)	d	258)	a	259)	a	260)	c
69)	b	70)	a	71)	b	72)	a	261)	a	262)	a	263)	b	264)	a
73)	b	74)	c	75)	c	76)	d	265)	c	266)	a	267)	c	268)	a
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81)	d	82)	b	83)	d	84)	b	273)	a	274)	a	275)	a	276)	a
85)	c	86)	a	87)	b	88)	d	277)	a	278)	b	279)	b	280)	b
89)	d	90)	d	91)	b	92)	a	281)	a	282)	c	283)	d	284)	a
93)	a	94)	d	95)	c	96)	b	285)	b	286)	b	287)	d	288)	c
97)	b	98)	b	99)	a	100)	c	289)	d	290)	b	291)	d	292)	b
101)	c	102)	d	103)	a	104)	b	293)	a	294)	c	295)	a	296)	a
105)	a	106)	a	107)	d	108)	a	297)	d	298)	c	299)	a	300)	d
109)	c	110)	c	111)	d	112)	c	301)	c	302)	b	303)	b	304)	c
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125)	a	126)	c	127)	c	128)	a	317)	b	318)	a	319)	d	320)	a
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133)	a	134)	c	135)	b	136)	a	325)	d	326)	b	327)	c	328)	b
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141)	a	142)	c	143)	c	144)	a	333)	d	334)	d	335)	b	336)	b
145)	d	146)	b	147)	a	148)	a	337)	c	338)	a	339)	d	340)	b
149)	d	150)	c	151)	d	152)	c	341)	d	342)	b	343)	d	344)	d
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165)	d	166)	a	167)	d	168)	a	357)	a	358)	d	359)	a	360)	d
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181)	c	182)	d	183)	a	184)	a	373)	c	374)	a	375)	c	376)	d
185)	b	186)	d	187)	c	188)	a	377)	a	378)	d	379)	a	380)	b
189)	d	190)	d	191)	d	192)	c	381)	d	382)	a	383)	c	384)	a

385)	**b**	**386)**	**b**	**387)**	**c**	**388)**	**d**
389)	**d**	**390)**	**b**	**391)**	**c**	**392)**	**d**
393)	**a**	**394)**	**a**	**395)**	**d**	**396)**	**b**
397)	**a**	**398)**	**a**	**399)**	**d**	**400)**	**a**
401)	**b**	**402)**	**d**	**403)**	**b**	**404)**	**d**
405)	**b**	**406)**	**b**	**407)**	**c**	**408)**	**a**
409)	**b**	**410)**	**a**	**411)**	**b**	**412)**	**b**
413)	**a**	**414)**	**b**	**415)**	**a**	**416)**	**b**
417)	**a**	**418)**	**b**	**419)**	**c**	**420)**	**b**
421)	**d**	**422)**	**d**	**423)**	**c**	**424)**	**b**
425)	**b**	**426)**	**c**	**427)**	**b**	**428)**	**b**
429)	**a**	**430)**	**d**	**431)**	**a**	**432)**	**c**
433)	**b**	**434)**	**b**	**435)**	**c**	**436)**	**a**
437)	**d**	**438)**	**d**	**439)**	**b**	**440)**	**d**
441)	**a**	**442)**	**a**	**443)**	**b**	**444)**	**a**
445)	**a**	**446)**	**b**	**447)**	**a**	**448)**	**c**
449)	**b**	**450)**	**b**	**451)**	**c**	**452)**	**b**
453)	**b**	**454)**	**d**	**455)**	**b**	**456)**	**d**
457)	**b**	**458)**	**d**	**459)**	**a**	**460)**	**a**
461)	**b**	**462)**	**c**	**463)**	**b**	**464)**	**a**
465)	**b**	**466)**	**c**	**467)**	**c**	**468)**	**c**
469)	**b**	**470)**	**b**	**471)**	**d**	**472)**	**d**
473)	**c**	**474)**	**d**	**475)**	**a**	**476)**	**c**
477)	**c**	**478)**	**b**	**479)**	**b**	**480)**	**c**
481)	**c**	**482)**	**d**	**483)**	**d**	**484)**	**d**
485)	**a**	**486)**	**d**	**487)**	**c**	**488)**	**a**
489)	**d**	**490)**	**c**	**491)**	**a**	**492)**	**c**
493)	**a**	**494)**	**d**	**495)**	**d**	**496)**	**a**
497)	**a**	**498)**	**c**	**499)**	**a**	**500)**	**a**
501)	**a**	**502)**	**b**	**503)**	**b**	**504)**	**b**
505)	**a**	**506)**	**d**	**507)**	**d**	**508)**	**a**
509)	**b**	**510)**	**d**	**511)**	**c**	**512)**	**a**
513)	**d**	**514)**	**c**	**515)**	**b**	**516)**	**b**
517)	**c**	**518)**	**c**				

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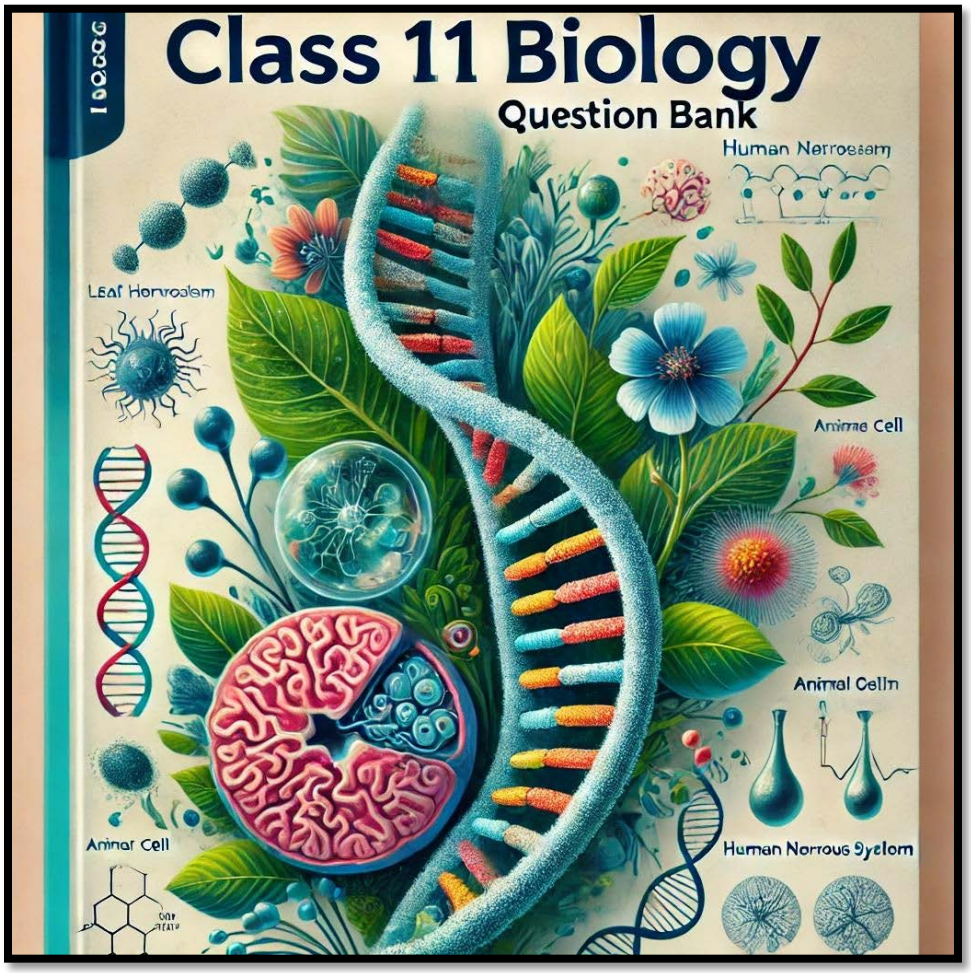

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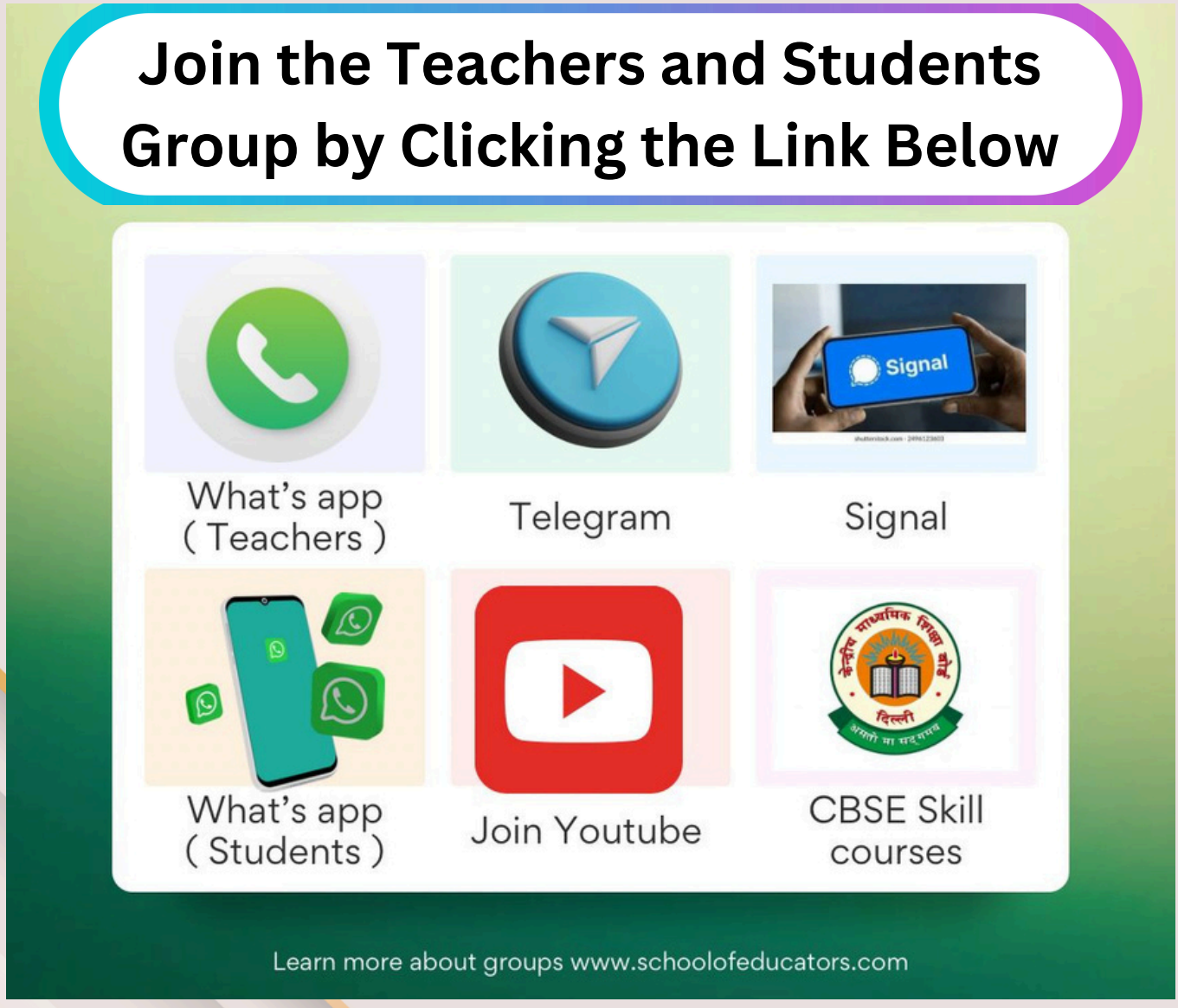

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Kindergarten to Class XII (For Teachers Only)

Class 1

Class 2

Class 3

Class 4

Class 5

Class 6

Class 7

Class 8

Class 9

Class 10

Class 11 (Science)

Class 11 (Humanities)

Class 11 (Commerce)

Class 12 (Science)

Class 12 (Humanities)

Class 12 (Commerce)

Kindergarten

Subject Wise Secondary and Senior Secondary Groups (IX & X For Teachers Only)

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APP. Mathematics

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Artificial Intelligence

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Principal's Group

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Kindergarten to Class XII (For Students Only)

Class 1

Class 2

Class 3

Class 4

Class 5

Class 6

Class 7

Class 8

Class 9

Class 10

Class 11 (Science)

Class 11 (Humanities)

Class 11 (Commerce)

Class 12 (Science)

Class 12 (Humanities)

Class 12 (Commerce)

Artificial Intelligence
(VI TO VIII)

Subject Wise Secondary and Senior Secondary Groups (IX & X For Students Only)

Secondary Groups (IX & X)

SST

Mathematics

Science

English

Hindi

IT Code

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1. Share your valuable resources with the group.
2. Help your fellow educators by answering their queries.
3. Watch and engage with shared videos in the group.
4. Distribute WhatsApp group resources among your students.
5. Encourage your colleagues to join these groups.

Additional notes:

1. Avoid posting messages between 9 PM and 7 AM.
2. After sharing resources with students, consider deleting outdated data if necessary.
3. It's a NO Nuisance groups, single nuisance and you will be removed.
   - No introductions.
   - No greetings or wish messages.
   - No personal chats or messages.
   - No spam. Or voice calls
   - Share and seek learning resources only.

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SKILL MODULES BEING OFFERED IN MIDDLE SCHOOL

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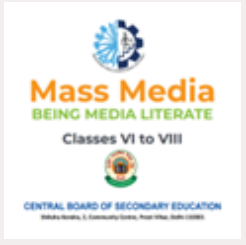
Design Thinking & Innovation

Financial Literacy

Handicrafts

Information Technology

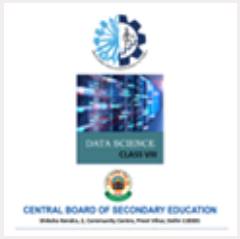
Marketing/Commercial Application



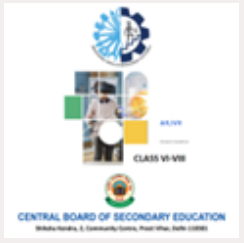
Mass Media - Being Media Literate

Travel & Tourism

Coding



Data Science (Class VIII only)



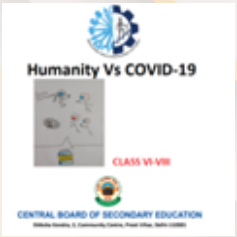
Augmented Reality / Virtual Reality

Digital Citizenship

Life Cycle of Medicine & Vaccine

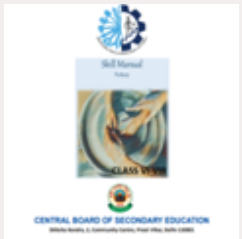
Things you should know about keeping Medicines at home

What to do when Doctor is not around



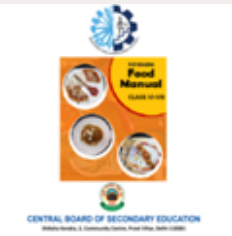
Humanity & Covid-19

Blue Pottery

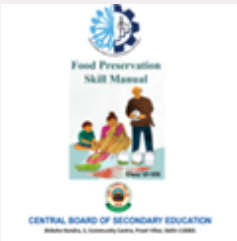


Pottery

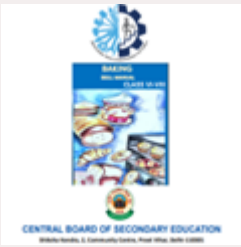
Block Printing



Food



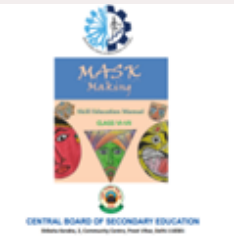
Food Preservation



Baking

Herbal Heritage

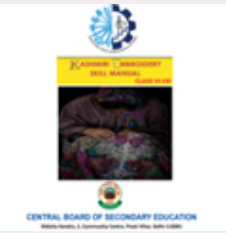
Khadi



Mask Making

Mass Media

Making of a Graphic Novel



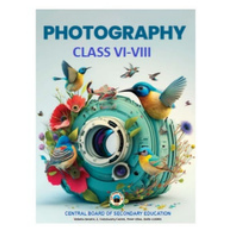
Kashmiri Embroidery

Embroidery

Rockets

Satellites

Application of Satellites

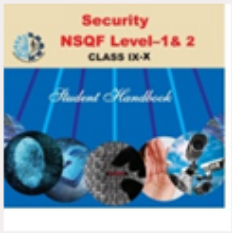


Photography

SKILL SUBJECTS AT SECONDARY LEVEL (CLASSES IX – X)

Retail

Information Technology



Security

Automotive

Introduction To Financial Markets

Introduction To Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

Banking & Insurance

Marketing & Sales

Health Care

Apparel

Multi Media

Multi Skill Foundation Course

Artificial Intelligence

Physical Activity Trainer

Data Science

Electronics & Hardware (NEW)

Foundation Skills For Sciences (Pharmaceutical & Biotechnology)(NEW)

Design Thinking & Innovation (NEW)

SKILL SUBJECTS AT SR. SEC. LEVEL (CLASSES XI – XII)

Retail

InformationTechnology

Web Application

Automotive

Financial Markets Management

Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

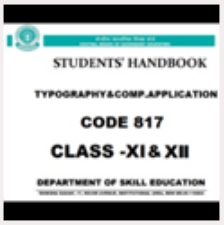
Banking

Marketing

Health Care

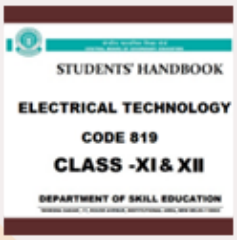
Insurance

Horticulture



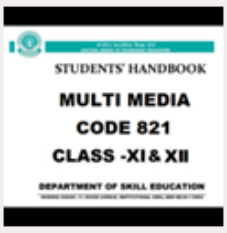
Typography & Comp. Application

Geospatial Technology



Electrical Technology

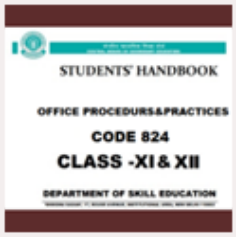
Electronic Technology



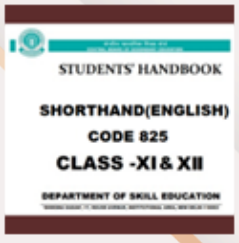
Multi-Media

Taxation

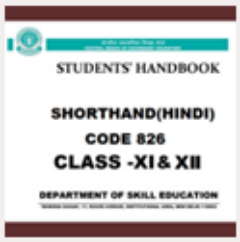
Cost Accounting



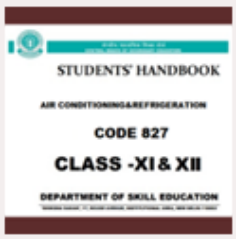
Office Procedures & Practices



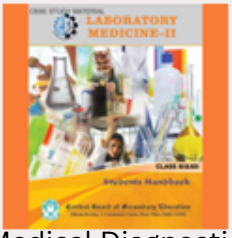
Shorthand (English)



Shorthand (Hindi)



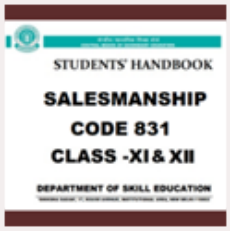
Air-Conditioning & Refrigeration



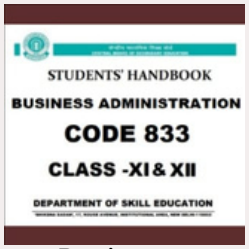
Medical Diagnostics

Textile Design

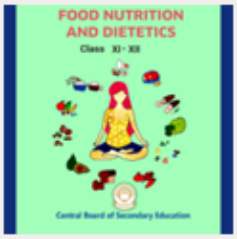
Design



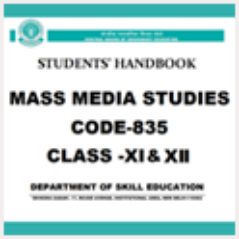
Salesmanship



Business Administration



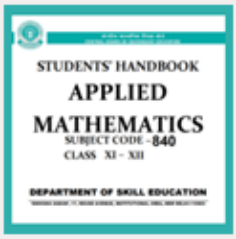
Food Nutrition & Dietetics



Mass Media Studies

Library & Information Science

Fashion Studies



Applied Mathematics

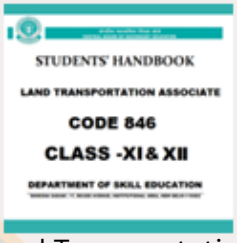
Yoga

Early Childhood Care & Education

Artificial Intelligence

Data Science

Physical Activity Trainer(new)



Land Transportation Associate (NEW)

Electronics & Hardware (NEW)

Design Thinking & Innovation (NEW)

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Class 9

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Class 10

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